REFINER
AND NATURAL GASOLINE MANUFACTURER

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GEORGE REID
Editor

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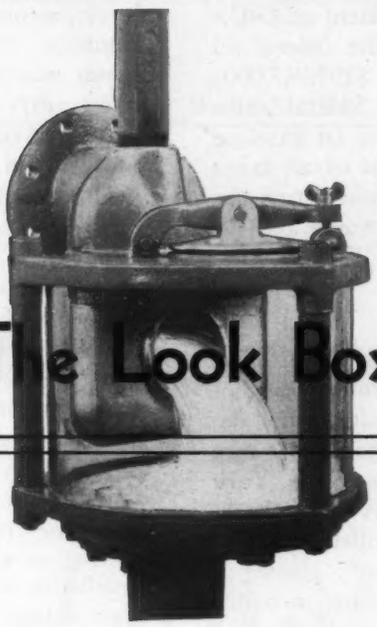

The Look Box

A NUMBER of things are happening or have just recently happened which point to that long looked for return of "good times." One is an unusual display of vitality of general business during this particular season. Summer is normally dull. Another is steel works operations have been mounting. The automotive industry, for another, is active, and the long dormant heavy industries are beginning to join the recovery parade. Recovery is noted in several foreign countries. All around and all over —things are better.

Better Times

The automotive industry is laying big plans. "Steel" reports that the automotive industry expects an increase of 15 to 20 percent next year or a total output of four million or more units. Within three years a new all-time top is expected, exceeding even 1929. Concensus of opinion among leaders of all business seemingly is that the basis for a generous credit inflation already has been laid. Inflate credit generously, and you have good times, it is said.

That opinion, however, and the gratifying out-of-season business pick-up simply reflects a healthy development of confidence—something that has been lacking for a long time. Returning confidence has been stimulated, by realization that many of the more serious threats have been dissipated because they were based on unconstitutional legislation. Industry is encouraged to go ahead once more on long time commitments.

Confidence is returning. With generous credit available at reasonable cost and more confidence, there follows more business, more construction and reconstruction and modernization. And if the automotive industry, a deep-thinking forward looking crowd, is right, then the petroleum refining industry may as well quit listening with its ear to the ground for better times and start preparing its manufacturing facilities and processes for better efficiency, larger crude runs, higher yields, better fuels and other products during the next few years.

THE petroleum industry, itself taxed till dizzy, and chief collector of other taxes till it is dizzier, is not alone in its misery of being combination taxee and tax collector. Its best customer, the motorist, also has something to complain about, and there is much evidence in many states pointing toward strenuous objection to high taxes on motor vehicles, fuels and lubricants.

Taxes

Motor vehicle operators in the United States paid taxes of $45.41 per vehicle on a national average last year, a study of automotive taxation by states recently completed by the American Petroleum Industries Committee reveals. In the announcement the committee points out that property taxes paid on motor vehicles were not included. The heaviest

levies on motorists were found to be in the form of gasoline taxes, which amounted to $30.48 per vehicle. Of this sum $22.66 was paid in state taxes and $7.82 in federal gasoline and oil taxes. License fees, including registrations, drivers' licenses, etc. totaled $12.23 per car, while $2.70 was paid to the federal government in automotive excise taxes, exclusive of those on gasoline and oil.

The 24,933,403 petroleum industry customers (vehicle owners) were taxed to the extent of $565,027,000 in state taxes on gasoline; the federal oil and gasoline taxes collected were $194,947,000; license fees were $304,928,000, and federal automotive excise taxes, exclusive of those on gasoline and oil was $67,384,802. Of the total of all taxes enumerated the petroleum industry must act as tax collector for the state and federal gasoline and lubricating oil taxes amounting to $758,974,000.

Solid Gasoline

MUCH ado about solid gasoline last month. Dr. Adolph Prusson, Daniel Guggenheim School of Aeronautics, New York University, who developed "Solene" the jelly-like substance, had a nice time entertaining the New York press, picture news services and others by firing tracer bullets into five gallon cans of the stuff; placing it on hot plates, building a fire and holding a match near to it with no dire consequences, and operating a one-cylinder, four-cycle test engine with success. And the press widely heralded the discovery throughout the land. And petroleum technologists, with whom we join, said "What of it?"

However, a company has been proposed for licensing interested oil companies to use the solidifying preparation with their own gasoline. This will be the Hydrocarbon Solidification Corporation. It will provide means for acquiring solidifying material or processes for making solid kerosene, solid furnace oils or solid lubricating oils, as well as gasoline. Costs, it is said, should not be over one or two cents more per gallon than liquid gasoline.

For airplane or automobile engines, and other internal combustion engines, it is said that the solidified gasoline eliminates the use of a carburetor. The solid fuel is placed in a container which is heated by engine exhaust and the heated fuel evolves a gas which is mixed with air through a butterfly valve in the line. Engine suction pulls the fuel-air mixture into the cylinders. Tests show slightly better efficiency than liquid fuel.

No doubt the solid fuels have possibilities. But there is nothing to get excited about. For use by air machines as a safety fuel, if it became standard practice at once, (which it will not for many years, at least) it would only make a small dent in the total motor fuel market. The current consumption in this country by airplanes is around 60,000,000 gallons annually, according to recent releases from the American Petroleum Institute quoting U. S. Bureau of Air Commerce. The United States total demand for motor fuel last year according to Bureau of Mines reports was approximately 17,000,000,000 gallons (in barrels, about 406,000,000).

Solidification of hydrocarbon fluids may be of popular interest, and ultimately of some real value. As a revolution of something or other, it is not such and it will have no immediate affect upon this industry. A study of patents as reported in Chemical Abstracts, and elsewhere a study of the literature, will show a number of such revolutionary developments (solid fuels) in the past in various countries. A manufacturer of a popular cigarette lighter was selling a jelly-like lighter fluid in tubes a few years ago. Some good friends in California were marketing 100 percent hydrocarbon solidified lubricants in 1927. There have been others.

The fact that gasoline may be solidified or is solid apparently matters but little. The fact that it is safer when solid may matter a lot. In peace time solid gasoline must compete with some very good safety gasolines now rather widely manufactured, and with relatively safe iso-octane now being prepared for airplane consumption by at least two installations of this lately developed process. In war time solid fuels may mean more than at present. It is a novelty now, and its commercial application rather narrowly limited.

So the trend remains one of installing and operating as efficiently as possible the very best of distillation and cracking facilities for production of high octane value motor fuels for that domestic demand market of over 400,000,000 barrels per year. Some place there is a limited market for solid gasoline and solid kerosene and other solid hydrocarbon products but not yet is it the automobile, the airplane, the tractor, the internal combustion engine generally, in this country nor abroad.

More Ideas

AFTER an absence of three months because of lack of space, the "Ideas" department in REFINER was resumed in the July issue when eight contributed "Ideas" were presented on pages 48a and 49a; this brings the total so far to 17 contributions. Comments from readers indicate that the department was missed during its three months leave of absence. Contributions from readers during the past few weeks are indicative of growing interest in the department.

Frankly, it is YOUR department to make of it what you like—and at REFINER's expense, for these acceptable items are paid for as stated in the foreword in the "Ideas" department. The response to previous published items like this one has been gratifying and there is enough material at hand and promised to carry the department along interestingly for a while. But the section can be enlarged upon and made more interesting only in one way, and that is through more "Ideas" coming from more contributors. In the future there will be plenty of space, and in most organizations there are plenty of "Ideas". Just attach a photograph or a rough pencil drawing to a letter about it or them and mail to the editor.

(*Continued on page 37a*)

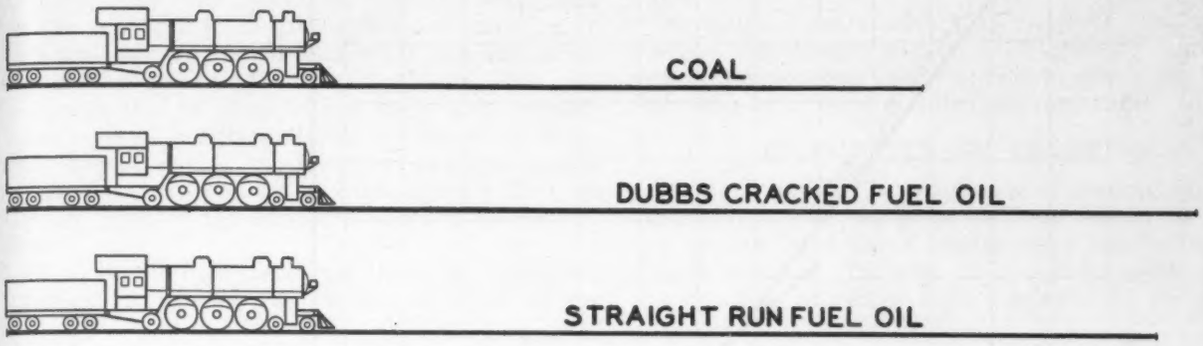

FIGURE 4

Relative distance of travel of locomotive per unit volume of various fuels.

Cracked Fuel

Gives More B.t.u. Per Dollar—in Less Space

GUSTAV EGLOFF

Universal Oil Products Company

FOR years the cracking process has been steadily improving the octane rating, the mileage delivery, the general performance ability of gasoline and establishing higher standards of quality, which today are universally recognized.

In the early days of cracking, production of gasoline was the sole objective. As the price of making cracked gasoline, refiners were obliged to take the by-products—coke or fuel oil—as they came, and to burn them or sell them for what they would bring—which usually was not much.

But today that situation is changed.

Research and development work have been directed toward improving the quality of the secondary products of cracking as well as the yield and quality of the gasoline. That work has been successful. Today cracked fuel oil exceeds the value of straight-run to about the same degree that cracked gasoline excels straight run gasoline.

Cracked fuel oil, formerly under suspicion and subject to a price penalty, is now finding an ever widening market—even a preferred market—as its superiority is becoming better understood.

What are the advantages possessed by cracked fuel oil as compared with the straight-run product?

First and most important, cracked fuel oil contains more B.t.u. to the barrel than straight-run oil. This means, the price of the two oils being equal, that the buyer of cracked fuel gets more heat units for his fuel dollar.

SAVINGS OF SPACE

Wherever cracked fuel is burned the savings it brings are important. But where bunker space is limited or where more space required for fuel storage means less space available for pay load, the savings are two-fold. That is why railroad companies and steamship lines have been especially quick to recognize the superior value of cracked fuel oil and to buy it in preference to straight-run. Packing more heat units into less bunker space means a saving on refueling time for a locomotive, greater cruising radius and more cargo space on a ship.

A second advantage is that cracked fuel oil has a

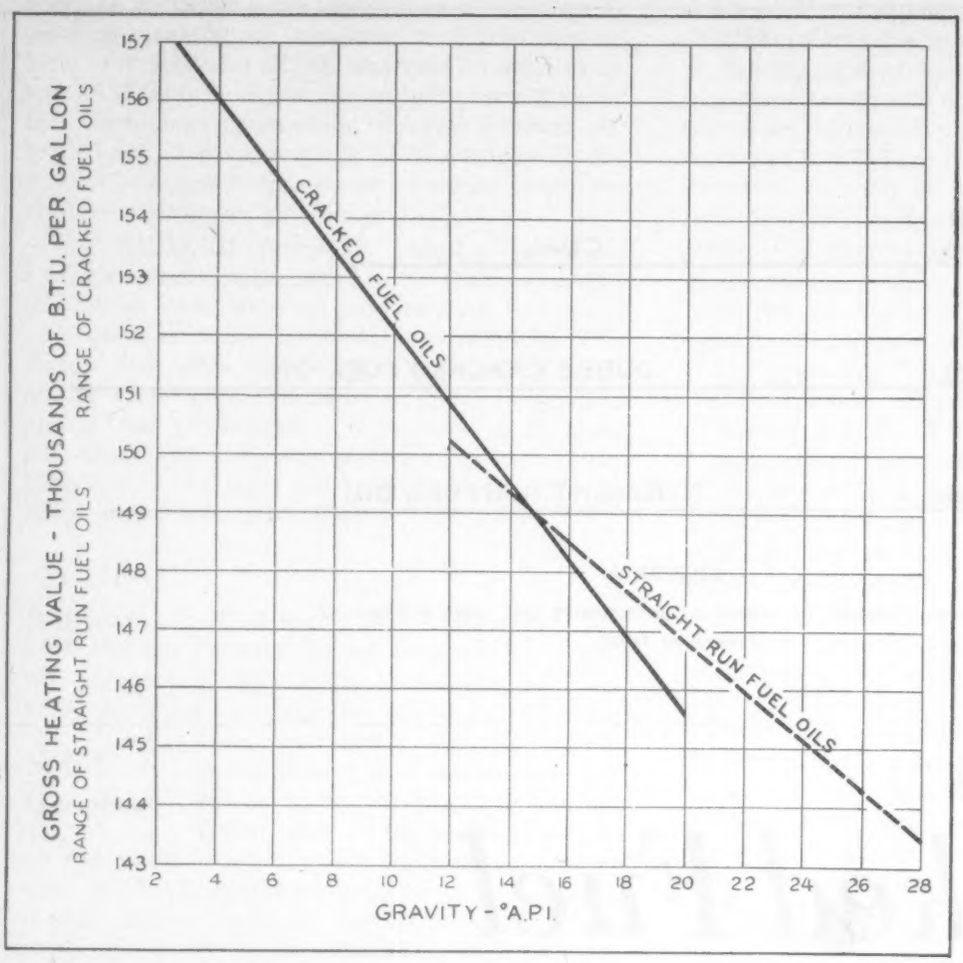

FIGURE 1

Calorific value per gallon, straight run and cracked fuel oils.

Data from Laboratories of Universal Oil Products Company.

lower pour point than straight-run fuel. This is important in cold climates.

As the number of cracking units in service multiplied and their operations increased to meet the growing demand for cracked gasoline, production of cracked fuel oil and coke increased beyond the amounts that could be consumed as fuel in the refineries, and their disposal became a serious problem.

The quality of cracked fuel oil in the early days was such as to justify, in large measure, the prejudice with which it was regarded by buyers.

In some cases the difficulty of selling the cracked fuel oil was so great that it offset the advantage of obtaining a high yield of gasoline.

So it sometimes became necessary, in order to make cracking profitable under certain market conditions, to reverse earlier operating policy and to run the cracking unit primarily to produce salable fuel oil and be content with whatever gasoline yield was consistent with this requirement. Such sacrifice is no longer necessary.

The great value of the later development in cracking technique lies in the fact that it has made possible maximum yield of gasoline of the highest antiknock value while producing at the same time fuel oil to meet—and better—exacting market specifications.

GROWING USE BY RAILROADS

Railroads are among the largest consumers of fuel oil in the United States. The importance of oil as a locomotive fuel is constantly increasing. It is interesting to note that in spite of the economic depression and the marked reduction of total fuel consumption in 1933 and 1934 as compared to 1929, the proportion of fuel oil to total fuel burned in locomotives has steadily increased, which shows a growing appreciation of its economy.

Aside from the greater number of B.t.u. per unit of bunker space which fuel oil delivers, one of its chief advantages is the greater thermal boiler efficiency obtained with oil as compared with coal.

According to the data published by the International Railroad Fuel Association, the average thermal efficiency of oil burning locomotives is 75 percent as against 60 percent for coal when hand fired, and 56 percent when stoker fired.

This is due to the better combustion efficiency obtained—no ash pit or fly ash losses—and a greater flexibility to meet varying load conditions with change in profile of the road bed.

When the relative efficiencies of coal and oil firing of locomotives are taken into consideration, the cost per million B.t.u. shows a differential in favor of coal of five percent, but that is not the whole story.

According to the report of the Interstate Commerce Commission, class "A" railroads consumed, as an average, 122 pounds of coal per thousand gross ton-miles of freight carried in 1930-1931. On a basis of calorific value of the two fuels, the weight of fuel oil required to haul 1000 gross ton-miles of freight is only 77 pounds.

Corrected for the relative efficiencies of 75 percent for oil and 60 percent for coal, the weight of fuel oil equivalent to 122 pounds of coal is further reduced to 61 pounds—a saving of 50 percent of the fuel haulage of the railroad.

The savings in haulage charges and storage losses

obtained when straight-run fuel oil is used will, in most cases, compensate for a five percent differential in favor of coal. The differential may be reversed when cracked fuel oil is used.

Cracked fuel oils are manufactured under carefully controlled conditions. This is the reason they possess advantages over the so-called straight-run fuels which are residues from atmospheric distillation of crude petroleum for the production of gasoline, kerosene, and other products.

The properties of straight-run fuels vary greatly with the type of crude used and the purpose of the refining operation. If straight-run gasoline is the major product of refining, a high gravity fuel oil containing most of the kerosene and gas oil will be produced.

If all of the lighter overhead fractions, including the greatest portion of gas oil, are distilled off the crude, a low gravity residue will be produced. A paraffin base crude may produce a high gravity fuel oil that will tend to solidify at comparatively high temperatures, while a considerably lower gravity fuel oil produced from the so-called mixed base crudes may flow more or less freely at ordinary temperatures.

Asphaltic base crudes may produce low gravity viscous or comparatively high gravity and fluid residues depending on the extent to which the lighter fractions have been distilled off the crude.

UNIFORMITY OF PRODUCTS

Table 1 shows the properties of cracked fuels obtained from different types of crudes when the charging stocks from these crudes were cracked by the Dubbs process. In spite of the great difference in the charging stocks and the crudes from which they

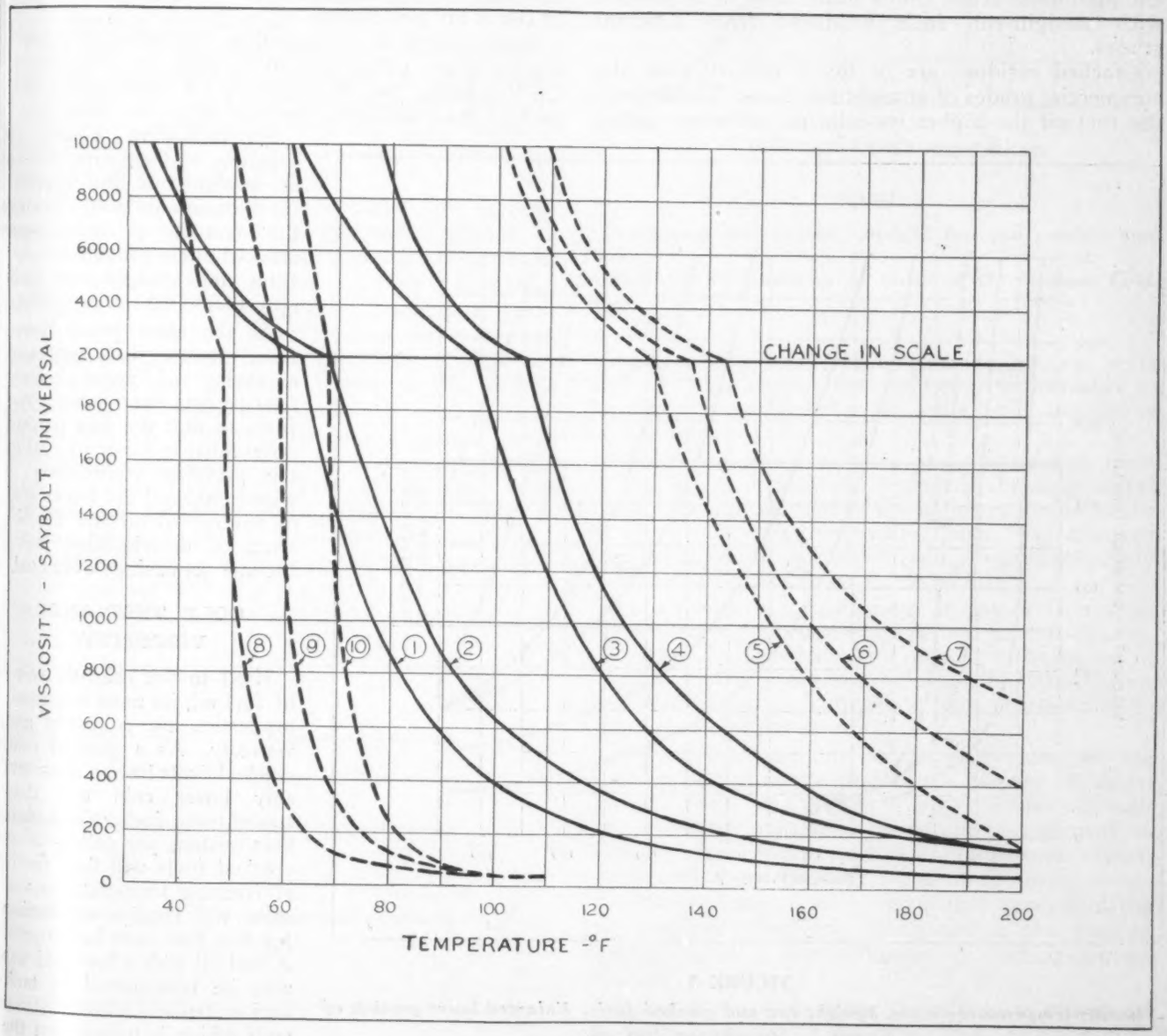

FIGURE 2

Viscosity-temperature curves, straight run and cracked fuels. Cracked fuel oil.

1. Pennsylvania Cracked..... 4.7° A.P.I. 153,780 B.t.u./Gal.
2. Gulf Coast Cracked..... 8.3° A.P.I. 153,200 B.t.u./Gal.
3. Mid-Continent Cracked.....7.2° A.P.I. 154,800 B.t.u./Gal.
4. California Cracked..... 8.6° A.P.I. 153,000 B.t.u./Gal.
5. Michigan Straight Run.....14.1° A.P.I. 149,300 B.t.u./Gal.
6. Mid-Continent Straight Run....14.0° A.P.I. 149,510 B.t.u./Gal.
7. Texas Straight Run.....16.5° A.P.I. 148,300 B.t.u./Gal.
8. Mid-Continent Straight Run...26.9° A.P.I. 143,950 B.t.u./Gal.
9. Gulf Coast Straight Run.....24.0° A.P.I. 145,186 B.t.u./Gal.
10. California Straight Run.....14.0° A.P.I. 152,065 B.t.u./Gal.

Data from Laboratories of Universal Oil Products Company.

TABLE 1

Properties of Various Cracked Fuel Oils (Dubbs Process)

Source of Crude	Type of Charging Stock	Gravity ° A.P.I.	Pour Point ° F.	Viscosity S.F. @ 122° F.	Flash ° F.	Fire ° F.	Btu. Per Gal.
Mid-Continent	Fuel oil	8.0	15	72	210	295	153,400
Mid-Continent	Gas oil	7.0	Below zero	18	200	255	154,030
Kansas	Topped crude	8.7	30	107	275	355	152,950
California	Fuel oil	7.5	45	190	270	350	153,700
Pennsylvania	Kerosene	7.4	Below zero	...	170	190	153,780
Pennsylvania	Fuel oil	7.3	0	54	233	295	153,850
Gulf Coast	Crude	7.9	8	34	210	305	153,450
Wyoming	Topped crude	7.9	30	74	230	305	153,450
Texas	Topped crude	7.7	25	69	240	335	153,600

were obtained, the properties of the cracked residues that determine their value as fuel oil differ little.

A user of cracked residues, therefore, is able to purchase a uniform fuel from a number of refineries in the same field or from refineries located in different producing areas. Such uniformity is impossible with straight-run fuels produced from different crudes.

Cracked residues are of lower gravity than the commercial grades of straight run fuels. The heavier the fuel oil the higher its calorific value per gallon even though its calorific value per pound (usually mentioned in the specifications) is lower than of the higher gravity fuels. For example, a 10° A.P.I. cracked fuel oil contains 152,100 B.t.u. per gallon and 18,260 B.t.u. per pound whereas a 21° A.P.I. straight run fuel oil contains 145,200 B.t.u. per gallon and 19,160 B.t.u. per pound.

Since fuel oil is purchased by the gallon the heating value per gallon should be used for comparison. On this basis, the lower gravity oil represents a better buy than the higher gravity oil at the same price.

Figure 1 shows a range of gravities and calorific values of straight-run and cracked fuels commonly sold. Taking the average of the range, cracked fuels contain 153,400 B.t.u. and straight run fuels only 147,300 B.t.u. per gallon.

At the same price, therefore, cracked fuels represent a saving of approximately four percent over straight-run fuels so that the five percent differential in favor of coal in the previous comparison is wiped out, and the lower cost of haulage of oil and the absence of deterioration losses become net savings over coal.

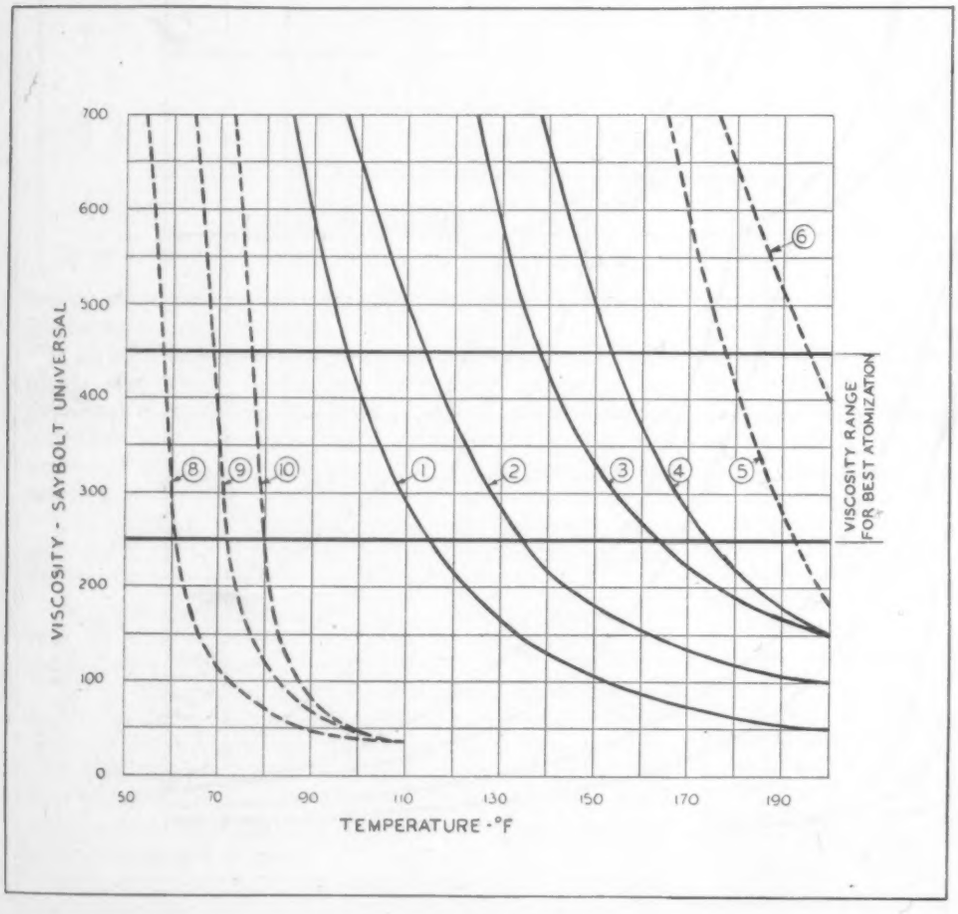

FIGURE 3

Viscosity-temperature curves, straight run and cracked fuels. Enlarged lower portion of Figure 2. Straight run fuel oil.

1. Pennsylvania Cracked ..... 4.7° A.P.I. 153,780 B.t.u./Gal.
2. Gulf Coast Cracked..... 8.3° A.P.I. 153,200 B.t.u./Gal.
3. Mid-Continent Cracked..... 7.2° A.P.I. 154,800 B.t.u./Gal.
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Data from Laboratories of the Universal Oil Products Company.

COLD TEST AND VISCOSITY

Next to the calorific value of fuel oil, its most important properties are cold test and viscosity. As a general rule, cracked fuels have a considerably lower cold test than straight-run fuels of the same heat content per gallon. Most cracked fuels will flow freely at freezing temperatures and some will require no heating for free flow even below zero. A fuel oil with a low cold test may be transported in tank cars or tenders without steam coils which is usually not the case with high B.t.u. value straight-run fuels.

The viscosity of an oil determines its rate of flow through a given opening at a given temperature and pressure. Viscosity changes

with temperature, and the rate of change of viscosity with temperature, particularly within certain limits of viscosity, determines the behavior of the fuel oil in the burner.

Figure 2 shows the temperature viscosity curves of a number of straight-run and cracked fuels. Cracked oils have a lower viscosity than straight-run fuels of the same B.t.u. value, as shown by comparing curves 1, 2, 3, and 4 with curves 5, 6 and 7.

Curves 8, 9, and 10 for lower calorific value per gallon straight-run fuels show lower viscosities than the cracked fuels, but the straight-run fuels represented by these curves have four to eight percent lower heating value per gallon than the cracked fuels shown on the curves.

In addition to having a lower viscosity for the same heat content per gallon, cracked fuels have a better viscosity-temperature curve, particularly at the temperatures to which fuel oils are usually heated to obtain the best atomization.

Most fuel oil burners, either of mechanical or atomizing types, operate best when the oil is heated to a temperature that would give a viscosity from 250 to 450 seconds Saybolt-Universal. This range is shown on Figure 3, which is an enlargement of the lower portion of Figure 2.

The low gravity, high B.t.u. value (per gallon) straight-run fuels must be heated above 175° F. to come within this range so that in many cases the desired viscosity is not reached and best atomization not obtained. The higher gravity, lower heat value straight-run fuels have a very steep curve through this range so that with a change of 3 to 4° F. in the temperature of the oil, the viscosity change will be greater than the whole range.

Cracked fuels will stay within the desired range with changes of temperature five to six times greater. Since a change of viscosity affects the quantity of oil that will flow through a given valve setting at given pressure, cracked fuel oil gives better regulation of fires under normal condition of fuel oil heating than can be obtained with straight run fuels.

Some railroads exclude cracked fuel oil from their present specifications, just as some motor fuel users excluded cracked gasoline from their specifications in

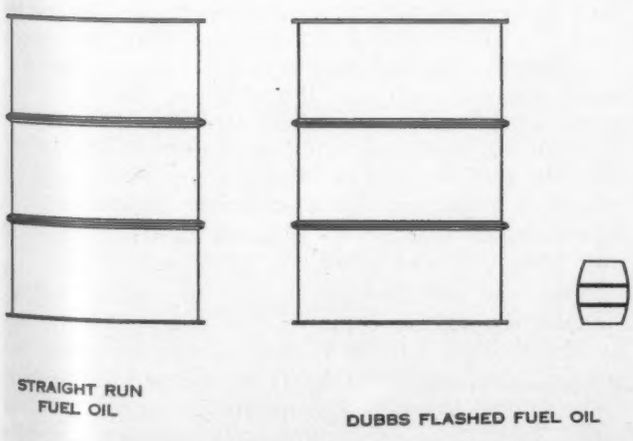


FIGURE 6

The keg at the right is drawn to scale to represent the bonus in B. t. u. the fuel buyer gets with a barrel of cracked fuel oil as compared to a barrel of straight run fuel oil.

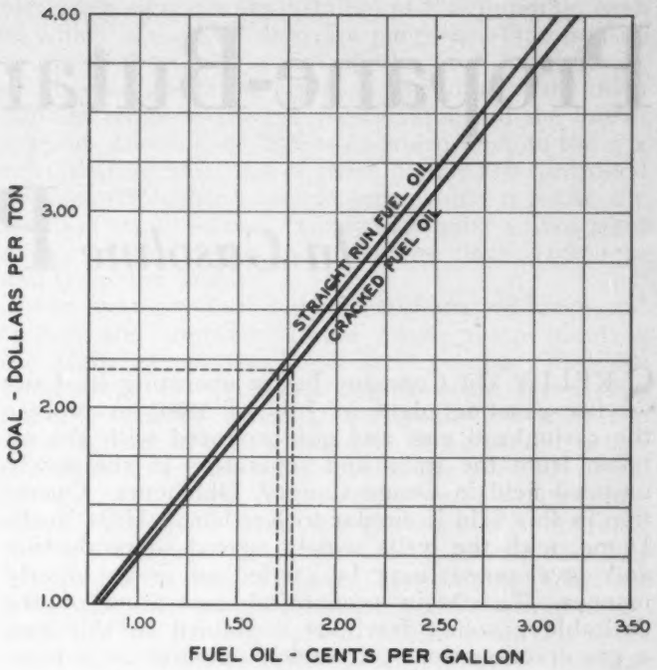


FIGURE 5

Equivalent cost of coal, straight run and cracked fuel oils.

Data from laboratories of Universal Oil Products Company.

the past. At present, cracked gasoline, because of its high anti-knock properties and better performance in the modern high compression automobile engines, is a premium product.

The U. S. Navy, a most progressive and most careful buyer of fuel oil, is one of the large users of cracked fuel oil. One of the major railroads on the Pacific Coast, after exhaustive tests, has changed from straight-run to cracked fuels almost exclusively and now is obtaining far better results.

An automobile manufacturer in the Detroit area, one of the largest consumers of fuel in that district, not only specifies that the fuel oil purchased be of cracked origin but imposes a penalty for straight-run fuel that has to be shipped to him occasionally to make up his requirements.

The cracked fuel oils produced by some of the cracking plants in the past had a number of shortcomings, such as irregular quality, occasional high B.S. and poor viscosity, formation of sediment in storage, etc., which resulted in unpleasant experiences with these fuels by some of the early users. The shortcomings were by no means general in the past and are completely eliminated in the cracked fuels produced by the well-operated cracking process of today.

Railroads or other large industrial consumers of fuel who exclude cracked fuels from their specifications because of difficulties they or someone else may have had with cracked fuel in the past, are depriving themselves at present of a superior product which has a higher heat value per gallon, lower cold test, lower B.S., and better viscosity characteristics than the average straight-run fuel oil used for industrial firing.

Propane-Butane *As Refrigerant In Gasoline* Plant Operation

J. C. ALBRIGHT

SKELLY Oil Company began operating its Fairfax gasoline plant in July of 1934, to process the casinghead gas, and gas produced with the oil taken from the traps and separators in the newly unitized field in Osage County, Oklahoma. Operation in this field is similar to Kettleman Hills North Dome, with the wells widely spaced so production and development may be carried on in an orderly manner. To obtain economical separation of the desirable gasoline fractions contained in this gas, a gas fractionation unit which operates at a pressure of about 300 pounds, gauge was installed.

A portion of the equipment used in construction was taken from other plants in different parts of Oklahoma not operating to their capacity. The gas fractionating column and the final stabilizer, together with some of the auxiliary equipment were built new for this plant. All of the used equipment, such as engines and pumps were thoroughly overhauled and reconditioned before they were placed in operation. Practically all of the laterals of the gas gathering system were built of salvaged line pipe, but the main 12-inch collection line, running from one end of the field to the other was built from purchased second-hand pipe.

Condition of the terrain made it difficult to ditch and lay the main vacuum lines and laterals to serve the leases and individual wells. Shooting was necessary in order to get the desired cover because of the shelly lime which outcrops in that area of Northern Oklahoma. The gathering system follows the usually accepted practice of laying one main vacuum line across the field throughout its longest part with the principal gathering lines reaching out at right angles. The lease lines branch off from these gathering lines and are connected for the most part, to the traps and separators located at the individual wells.

Only a small portion of the gas taken from the wells is what is termed casinghead gas, because of the fact that the wells are still new and flow with sufficient pressure that separation of the gas from the oil may be accomplished more satisfactorily at the traps and separators. In the older section of the field, which is to the south, the wells are being pumped and this gas is taken from the usual casinghead connections. Because of the orderly development of the field and the conservative production methods used, it is likely that most of the gas produced in the South Burbank field will be taken from traps and separators for several years.

The equipment used to handle the gas taken from the main vacuum line consists, in the first part, of 10 165-horsepower gas engine-driven direct-connected compressors, each unit being equipped with a high and low pressure cylinder. The engines themselves were originally designed to operate with the exhaust coming from the usual stool placed between the foundation blocks and the engines, with the exhaust lines buried, or placed in conduits leading from the engine room to the mufflers. When they were moved from the old locations, where they had been used for several years, arrangements were made to invert the power cylinders so the exhaust lines and mufflers could extend vertically through the roof of the building. The heads were overhauled and replaced with new ones fitted with gas injection valves so that more power could be generated and to conserve the fuel gas.

The gas is brought in from the field under as high pressure as is possible, consequently very little vacuum is needed. The first compression stage is carried up to about 50 pounds with the gas passing through overhead lines to the cooling tower. Several atmospheric tubular cooling sections are used to cool the gas before it is returned to the intake of the high pressure cylinders. The second stage compression boosts the pressure to about 300 pounds after it is received from the cooling units at a temperature of 80 °F.

The gas fractionator column is 48 inches in diameter and equipped with 24 bubble trays. Several intake nozzles were connected to the column so the operation of the tower may be varied to meet changing conditions arising in the plant. The high pressure gas enters the column through the designated nozzle at about 140 °F. to conserve heat, and passes up through the trays in the tower, coming into intimate contact with the liquid upon the trays and around the bubble caps. Selective separation of the gasoline fractions is carried out progressively in this manner until the gas reaches the top of the column, which is maintained at a sufficient temperature by liquid reflux control so that all desirable propane and butane is extracted.

After the stripped gas leaves the outlet connection on top of the column, it is conducted through overhead lines to the cooling tower to lower the temperature, and after this it is returned to the plant to be passed through a propane-butane refrigerating unit. This piece of equipment is a shell and tube unit where a temperature sufficiently low is obtained to effect the condensation of all the remaining low boiling gasoline, such as propane and butane. This is subsequently collected and used for reflux control

of the fractionating column. The temperature obtained on this unit is about 54 °F, and the cooled residue is passed through a tube and shell exchanger through which the stripped gas from the top of the fractionating column also passes so that the low temperature may be made available in reducing the temperature of the gas before it passes through the atmospheric sections in the cooling tower.

The raw gasoline, made by high pressure fractionation, is removed from the base of the reboiler of the column and fed directly to the final fractionator column. This tower is 30 inches in diameter and contains 30 bubble caps. The operation of this fractionator is similar to the regular routine ordinarily followed in finishing gasoline, and any grade of gasoline may be taken from the base by changing the operating procedure. The lighter fractions not desired in the finished product are removed in a vapor form from the top of the column and condensed again to be used for liquid reflux.

The condensate from the refrigerating system is collected in an accumulator which in turn delivers the liquid to a large horizontal pressure vessel which is used as a supply tank and storage receptacle for the condensate. Liquid hydrocarbons condensed from both the refrigerating unit and the condensers placed on the overhead line from the final gasoline stabilizer are used to reflux both columns. At present, the finished gasoline has a vapor pressure of only 14 pounds, and the excess lighter fractions not needed in the manufacture of this grade of gasoline are gradually dissipated from the system through the pumping of reflux to the gas fractionator to pass to the residue system carrying fuel to the field.

INSTRUMENT PANEL

The instruments needed to control the operation of the plant are assembled on a common panel located in the pump room near the stabilizer and fractionating column. Four steam-driven simplex close clearance pumps were installed in this building, each of which is used for separate purposes. One is used to pump the raw gasoline to the final fractionator, another to handle the reflux to the column, the third handles reflux to the gas fractionator and the fourth supplies gasoline, or lighter hydrocarbons, to the gas refrigerating unit. All of these pumps are controlled by adequate control instruments which regulate the speed of reciprocation. Lubricated plug valves were placed on the intake and discharge lines leading to and from the pumps.

The auxiliary building was constructed large and roomy, and contains all the water pumps used in the plant except the boiler feed pumps. Two 80-horsepower two-cycle gas engines were set in this building, one of which is always in use with the other setting idle as a stand-by to be started when necessary to repair or adjust the one normally used. Instead of the usual motor-driven pump units, transmission of power from the gas engine is obtained through the use of a line shaft running the full length of the auxiliary room. This shaft was installed with low-down pillars fitted with self aligning hangers with the driving pulleys placed near the posts to secure added stability and rigidity. Friction clutches were placed on the shaft opposite each gas engine so that either or both of the gas engines may be operated at will. The excavated pump bay was built sufficiently large that each pump is some distance from another which provides space enough for the operator of the plant or mechanic to adjust and repair the units without interference from other

Propane-Butane refrigeration unit, showing construction details. Temperature of 54° F. is secured.

moving machinery. Adequate guard rails and other protective equipment was installed to prevent an employee from becoming entangled with belts and pulleys.

The plant is located on the high bluff south of Bird Creek near the oil field town of Little Chief, thus securing sufficient drainage. The gasoline storage tanks, which are adequate are in the lowest corner of the yard so that escaping vapors, if a gasoline line should rupture, would not travel toward the boilers or engine room. The gasoline is only slightly sour and needs to be treated with but a small amount of chlorine, which is used in the form of bleaching powder.

Soon after the plant was placed in operation, it was discovered that, because of the propane and butane being returned to the residue gas, the B.t.u. value was so high that power was being retarded. By carrying on a series of experiments with the mixing valves on the power cylinders of the gas engines it was found that by diluting the gas before it was passed through these valves, added power could be generated with a corresponding lessening in premature combustion and the resulting "pinging" in the cylinders. In order to accomplish this, a steam-driven air compressor was installed which delivers a quantity of air to the plant fuel lines leading to the gas engines. The amount of air used in this manner runs in the neighborhood of 25 percent of the total gas used and provides more flexible operation than when the engines are burning residue gas rich in B.t.u.'s.

The water produced for plant cooling and boiler use is hard, containing both permanent and temporary hardness, and to prevent treating a large volume of water continuously for boiler feed make up, all the steam used in the plant is condensed and placed in a tank for re-use. Exhaust lines are laid from the steam pumps in the plant as well as from the steam traps at the reboilers of the two columns, which carry the condensate and steam to the boiler room. These lines also are placed on overhead stanchions, but not insulated so all atmospheric cooling can be employed in reducing the temperature of the water and exhaust.

Back pressure maintained on the pumps and reboiler steam traps is about 30 pounds which is sufficient under the present method of plant operation to condense and save all of the steam coming from the various units. The efficiency of the boilers has been increased considerably by feeding hot water directly to them instead of using a large amount of cold feed water. In addition to the saving of water, as well as chemicals needed to reduce the hardness, the boilers operate more satisfactorily with little or no scaling.

A small pump is located in the boiler room which is controlled by a liquid level instrument placed on the condensed water supply tank. As the level falls, due to natural loss of water, a valve placed on the steam line at this pump is opened which permits the smaller unit to deliver raw water to the supply tank. This pump only operates intermittently as necessity arises, with the two regularly operated boiler feed pumps taking suction from the supply tank.

Oil used in the compressor crank cases is changed regularly to prevent contamination by condensation of gasoline in the cylinders following the piston rods. Oil following the rods in the power cylinders and passing through the packing, which is necessary for lubrication of these parts, also contributes to contamination of crank case oil with finely divided carbon particles. As drainage is carried out regularly, the used crankcase oil is transferred to a building near the boiler room where it is reconditioned for further use in the engines. Here an ingenious apparatus acts both as a low temperature distillation unit, for removing the lighter fractions from the drained oil, and a filtering device which effectually removes the free carbon from the oil in process. This apparatus is built in two sections, one above the other and heated with steam directly from the boilers, supplemented by gas burners placed under the chambers. The upper chamber is used to heat the drained oil to a sufficient degree that the gasoline is driven out, temperature is held sufficiently low that decomposition is prevented.

Steam is used in direct contact with the oil to furnish agitation and to prevent flashing of the vapors driven from the oil while under atmospheric distillation. When the temperature of the oil has been brought up to the desired point, a predetermined amount of filtering material is added to the oil as a contact agent. This clay is a specially prepared product manufactured for lubricating oil manufacturing processes, and is thoroughly mixed with the oil in upper chamber. When mixing has been completed, the slurry is dropped to the lower chamber through a gate controlled by-pass where the oil is separated from the clay material.

The lower compartment of the reconditioning unit is fitted with a removable head which is held in place by bolted spiders, or crows-feet, and supplied with an oil-tight gasket. A sheet of filter paper is placed over a grid so that the oil may pass to the outside container when sufficient pressure is applied. The color of the oil may be controlled by adding a larger amount of filtering material when making the slurry, but the objective desired is the removal of excess free carbon. Since this unit has been placed in operation, all of the reclaimed lubricating oil has been passed through the apparatus with satisfactory results.

More gas is available for plant extraction than the size will justify, due to a larger amount of tank vapors and gas from casingheads formerly treated in a smaller plant situated in another portion of the field being transferred to this main plant. Plans are being consummated which will result in enlarging the plant by the addition of a low-pressure absorption unit which will operate in conjunction with the fractionating equipment.

Plans also are being carried out which will result in the pumping of all natural gasoline manufactured in the combined plant to this company's major plant at Lyman, in the old Burbank field. Fractionation of this gasoline in a more or less centrally located plant can be carried out more successfully because Skelly Oil Company has installed a complete arrangement of propane, butane and other special columns at Lyman, as well as a complete arrangement of equipment used in manufacturing Skelgas.

The design of this plant, as well as the additions and improvements, is under the direct supervision of J. W. Vaiden, manager of the gasoline division of the production department, Skelly Oil Company.

Selective Light Distillate ... Refining and Recovery of By-Products

SUMNER E. CAMPBELL
Chief Chemist, MacMillan Petroleum Corporation

RAPID development and improvements during the last few years in internal combustion engines, together with the great demand for satisfactory fuel for these engines, has stimulated much research and development of refining processes. Naturally the petroleum industry has been looked to for these fuels. Considering the wide variations in both physical and chemical characteristics of the crude petroleums which are the source of these fuels it is not surprising that refining processes have in many cases become more complicated. It has long been the aim of the refiner to develop continuous processes which would not only produce fuels of the desired quality, but at reasonable cost. Especially during the last few years has the subject of selective refining come to the fore. Because of the improved quality of the products obtained by selective refining and because of the frequently lessened yields, much study has been given to the subject of by-products in order to make these new materials at least in part offset the increased expense of manufacturing these higher quality oils. These new developments have taken advantage both of the difference in physical characteristics of distillates to be refined, as well as their variable chemical properties.

In this article is described a continuous and economical process[1] of refining light distillates, and straight-run California gasoline distillate will be used as an example. It should be borne in mind, however, that while impurities may be present in lesser volume in straight-run gasoline distillate, the principles involved, both physical and chemical, in their removal, also have application to distillates obtained by other refining methods.

It is well known that for the production of high quality motor fuels several different classes of chemical compounds must be removed. Where, for example, these compounds occur in straight-run distillates they are practically always present in greater volume in light distillates obtained by cracking gas oil or residuum. Their presence in these cracked distillates materially complicates the refining operation by commonly used methods.

Figure 1 is a flow sheet illustrating an installation of eight towers. Figure 2 shows a glass experimental unit. Figure 3 shows a six-tower commercial installation. Referring to Figure 1, the first six of the towers are filled to about the point A with finely divided inert contacting material, so arranged as to avoid interference with valve operation, clogging of lines, etc. No. 16 silica has been found to be an excellent packing material, although other materials such as broken glass, etc., may be used. At the bot-

[1]The above described processes are fully protected by issued patents and pending applications.

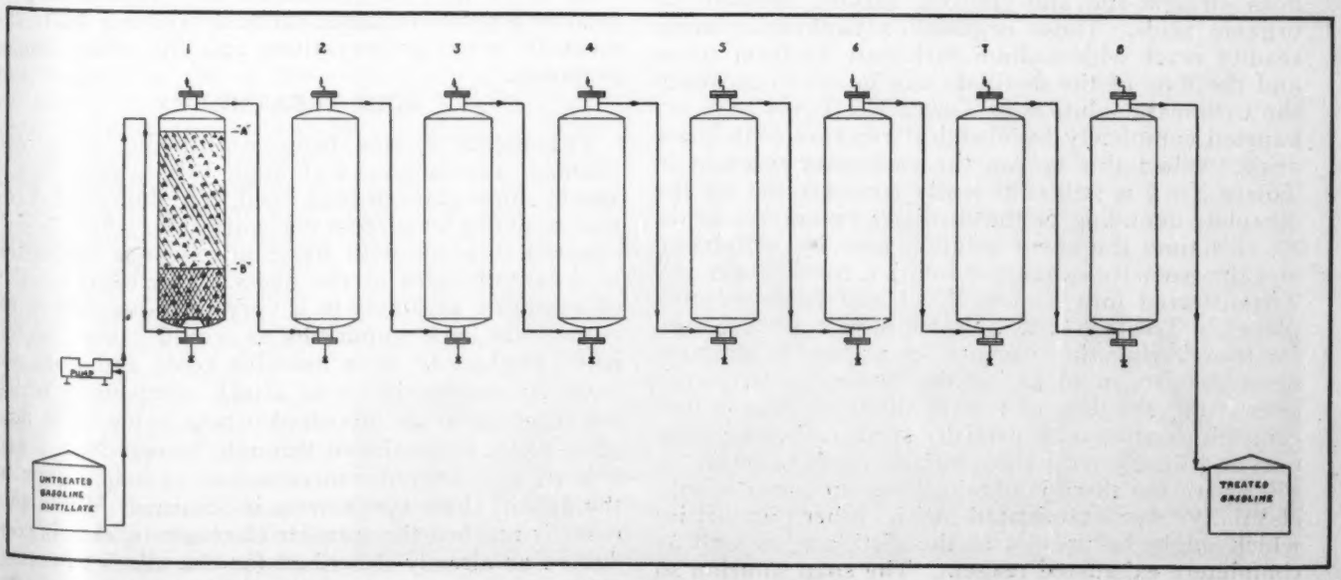


FIGURE 1
Flow Chart of Continuous Treating System.

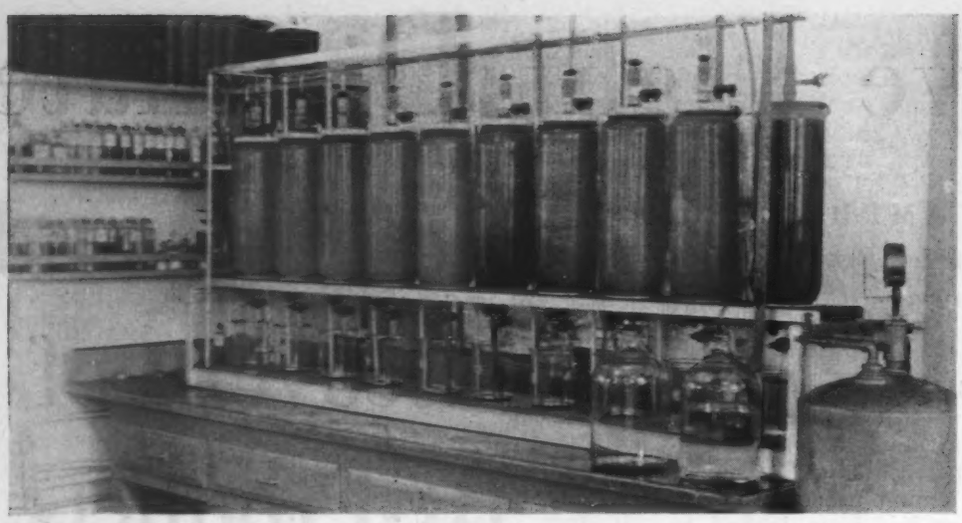


FIGURE 2
Laboratory experimental continuous treating system made of glass.

toms of the towers, just above where the distillate enters, suitable perforated distributors are provided. These may consist of perforated hemispheres, perforated crosses or the like, the object of these being both to prevent the packing material from getting into the valves at the bottom of the tower and to more evenly distribute the distillate within the tower.

Towers Nos. 7 and 8, which are of like construction, are used as filters.

CARBONATE TREATMENT

Towers Nos. 1 and 2 are filled about one-quarter full (shown at B) with a solution of sodium carbonate or its equivalent, of about 15 percent concentration. Untreated gasoline distillate is pumped through a riser at the side of the tower, discharging into the bottom of the tower. Due to the finely divided contact material and to the difference in specific gravity between the distillate and the reagent, both efficient contacting and complete separation can be obtained.

There are present in California light distillates, both straight-run and cracked, varying amounts of organic acids. These organic or naphthenic acids readily react with sodium carbonate to form soaps and the flow of the distillate can be continued until the carbonate solution in Tower No. 1 has been exhausted completely by chemical reaction with these acids. When this occurs the carbonate solution in Tower No. 2 is still sufficiently concentrated for the complete denuding of the distillate or organic acids. At this time the spent solution may be withdrawn and the partially exhausted solution from Tower No. 2 transferred into Tower No. 1 and fresh solution placed in Tower No. 2. Suitable blow cases are used for transferring the reagents. A preferable arrangement consists in so piping the towers as to permit alternating the flow of raw distillate so that it first comes in contact with partially spent carbonate solution and finally with substantially fresh reagent. In this operation there is obtained a soap solution substantially uncontaminated with other impurities which might be present in the distillate, as well as completely exhausted reagent. The soap solution so obtained is of value for some purposes when freed from distillate, or it may be concentrated if desired. Further, no acidification of the soap solution, the free organic acids are liberated and are of themselves valuable for making soaps which are excellent emulsifying agents for spray materials, cutting compounds and the like or they are the source of material which is chemically reactive for other purposes. As the saponification value of these acids is in the neighborhood of 350, some idea of the readiness with which they form soap is indicated.

CAUSTIC ALKALI TREATMENT

The distillate leaving Tower No. 2 and containing no organic or naphthenic acids passes through Towers Nos. 3 and 4, which contain a solution of caustic soda or its equivalent, to about the depth B, shown in Tower No. 1. The concentration of the caustic soda solution may vary considerably but one of about 10 to 20 percent has given good results. The same principles of contacting and separation apply in Towers Nos. 3 and 4, to the end that the distillate is both intimately contacted with the reagent and also completely separated therefrom as it leaves the top of these towers. Most of these gasoline distillates, especially cracked distillate, contain varying amounts of phenolic compounds which are insoluble in carbonate solutions. They therefore remain in the distillate passing through the carbonate towers Nos. 1 and 2 and are removed by reaction with the caustic soda solution to form phenates. The flow of distillate through these towers is continued until the reagent in Tower No. 3 has become exhausted completely, when the same procedure is followed for transferring the partially spent reagent in Tower No. 4 and renewing it with fresh, as has been described in the case of the carbonate solution. This provides a highly concentrated sodium phenate solution, which, on acidification, liberates the free phenols, which may be utilized for any desired purpose such as for disinfectants, cattle spray, as a toxic element in wood preservatives and for other similar purposes.

ACID TREATMENT

The distillate, free from naphthenic acids and phenols, now is passed through two towers, Nos. 5 and 6, either glass or lead lined, containing sulphuric acid of about 50 percent concentration, which is well adapted to react with basic nitrogenous impurities to form sulphates of the bases. This concentration of sulphuric acid acts in a very mild manner to remove only such impurities as would cause the finished product to have unstable color and does not react so vigorously as to attack compounds which are responsible for increased octane value. The flow of distillate is continued through Towers Nos. 5 and 6 until any desired concentration of acid liquor in the first of these two towers is obtained. When this point is reached the transfer of reagents, etc., is conducted as already described for the alkali towers.

Free nitrogenous bases are obtainable from the concentrated acid liquor at relatively low cost by

well known methods of decomposing the sulphates of the bases by the use of excess alkali, which may be any of a number of alkaline materials. These free bases are highly toxic and when properly utilized furnish a highly efficient element in spray materials, for plants, trees, chicken houses and for like purposes.

FILTRATION

The distillate next is passed through the two filters Nos. 7 and 8, which are filled with granular California decolorizing clay, fuller's earth or similar material adapted to remove the last traces of color-bearing compounds and to impart brilliancy to the gasoline. The distillate is permitted to flow through these filters in series until the color stability of the gasoline issuing from the top of the first filter drops below a desired point, when the filter is drained of gasoline, the clay removed and replaced with fresh clay. At this time the clay in Tower No. 8 is still sufficiently fresh to insure the removal of all constituents which would cause the gasoline to be unstable in color. The piping to Towers Nos. 7 and 8 preferably is arranged so as to permit flowing the gasoline alternately to one or the other.

OPERATION

The cost of treating by the above described means is exceedingly low as it requires very little labor except for occasional inspection and for the changing of reagents and clay when necessary. As an example, in a commercial unit refining between two and three thousand barrels daily, it is only necessary to change alkali about every 10 or 12 days and acid about every 20 days. The use of clay has come to be considered by many refiners as adding an increased expense in refining light distillates, whether it be either finely divided contacting clay or percolating type clay, but when it is considered that between 350,000 and 400,000 barrels can be put through 10 tons of clay and still have gasoline of excellent color stability, the cost of using the clay is insignificant. In fact, in one commercial installation as much as 460,000 barrels have been put through 10 tons of clay, still with extremely high color stability.

COSTS

With a properly arranged and operated system of this kind not only is the complete removal of the different classes of impurities already described possible but the separation of gasoline from reagents and reaction products is so complete that reagent free gasoline is taken from the top of each and every tower in the system. This is highly important as no alkali is necessary to neutralize entrained acid, as is common treating practice, nor is the reverse true. Each and every reagent employed in the system has its specific and definite function, namely to chemically react with a particular class of impurity which it is adapted to remove.

It may also be of interest to note that an untreated straight-run gasoline distillate containing a sufficient quantity of unstable impurities to cause it to turn yellow rapidly can be put through the refining steps as described above and at each stage of the system obtain substantially water white oil.

Such a continuous treating operation has been in constant commercial use for more than five years, treating in this manner between three and four million barrels of gasoline.

If it is not desirable to separate organic acids from phenols in the treating system, the raw distillate can be passed directly to the caustic alkali towers, in which case, of course, two less towers are necessary to adequately refine the gasoline.

All of the different classes of impurities above described have a gravity in the neighborhood of 17.0 A. P. I., and as they are rich in carbon if permitted to remain in motor fuel they contribute materially to the sooting of spark plugs and an increase in carbon deposit in the engine.

Cost Statement for Treating a Straight-Run California Gasoline Distillate

Alkali (Approx. 20 percent NaOH)			
Alkali charge to tower (bbls.). 6	$0.031 lb.	$1.22	
Distillate treated (bbls.).....12,000			
Lbs. of alkali per bbl. 0.035			
Cost of alkali per bbl.			0.0011
Acid (50% H_2SO_4)			
Acid charge to tower (lbs.)...2000	$0.005 lb.	$10.00	
Distillate treated (bbls.).....31,500			
Lbs. of acid per bbl. 0.06			
Cost of acid per bbl.			0.0003
Clay (California Granular)			
Clay charge to tower (tons) 10	$25.00 ton	$250.00	
Distillate treated (bbls.).....350,000			
Lbs. of clay per bbl. 0.057			
Cost of clay per bbl.			0.00071

RECAPITULATION

Alkali (per bbl.)	$0.0011
Acid (per bbl.)	0.0003
Clay (per bbl.)	0.00071
Total cost per bbl.....	$0.00211

NOTE: These figures represent the cost for treating a straight-run California gasoline distillate to produce at all times gasoline that is 30+ color (Saybolt) and color stable in direct sunlight. Also, the above figures do not take into account the value of the by-products obtainable from the spent reagents.

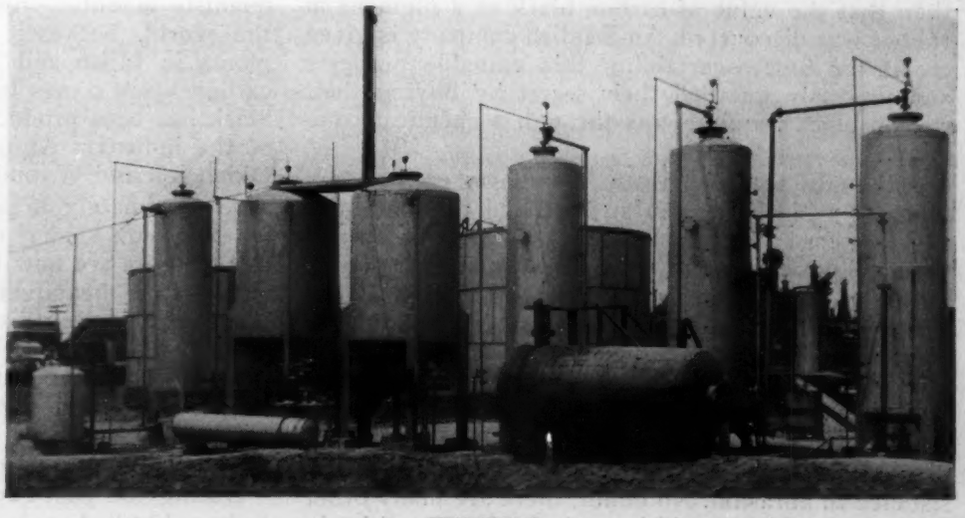


FIGURE 3
Commercial installation consisting of six treating towers.

History, Use and Manufacture of

Carbon Black . . .

R. G. ALLEN
Cabot Companies, Pampa, Texas, and
H. W. PRICE *and* E. B. REINBOLD
J. M. Huber Corporation, Borger, Texas.

Presented at the Spring Meeting of the Mid-Continent District, A. P. I. Division of Production.

ALTHOUGH soot in various forms has been known and used since the beginning of time carbon gas black was first manufactured in the year 1864 by J. K. Wright, a Philadelphia ink maker. At that time the price was from $3.00 to $5.00 per pound, and while the usefulness of the product was unquestioned, the price was so exorbitant that it was impossible to extend its use or even to make its use a popular one. Construction of additional plants in Pennsylvania, Ohio and West Virginia brought the price down to 60 cents per pound.

The next eighteen years saw enormous development in the technique of manufacture; hundreds of patents were issued, many of them worthless, but some two or three of which proved extremely valuable and are the basis of the processes now in use.

At the beginning of the twentieth century there was a production of about 20,000 pounds per day, and the price had already dropped to 6 cents per pound. A factory had been started at Grantsville, West Virginia, which had the unheard of and unbelievable production rate of 10,000 pounds per day. For fifteen years this plant, which today would be of small importance, remained the largest in the world.

USES

In 1915, on account of the World War, the price of zinc oxide went so high as to make its use prohibitive in rubber compound. It was then that rubber chemists instituted a search for other compounding ingredients that might be used in the manufacture of rubber products, principally tires, and it was then that the value of carbon black as a pigment in rubber was discovered. An English company is given credit for first ascertaining this valuable property and jealously guarded their secret by buying their carbon black requirements through a chemical company.

Although one American manufacturer had announced a black tire during 1915 and the black Silvertown cord appeared in 1916 and were for a short time unique, other tire companies immediately took up the use of carbon black, and soon there developed a serious shortage. In spite of frenzied building of plants, particularly in Louisiana, prices mounted to over 20 cents per pound, but the shortage continued until 1924.

Carbon black, when compounded into rubber doubles its tensile strength and quadruples its resistance to abrasion. No doubt, there are many other substances which would have these same qualities in rubber if they could be found or could be ground to the microscopic size of the carbon black particle. It is so fine that the highest powered microscope has been unable to shed any light on its size or partical shape, and its size is only estimated by indirect methods of chemical calculation to be approximately one-five hundred thousandths of an inch in diameter.

There has been much advance over the past several years in tire compounding and building, but carbon black stands alone as an indispensible ingredient in increasing the strength of the rubber compound, and added tremendously to tire mileage due to its added abrasive resistance. In every set of tires for a medium size car there is approximately one standard package of 12½ pounds of carbon black, for in standard compounding of rubber for tires there are 50 pounds of carbon black added for every 100 pounds of crude rubber used.

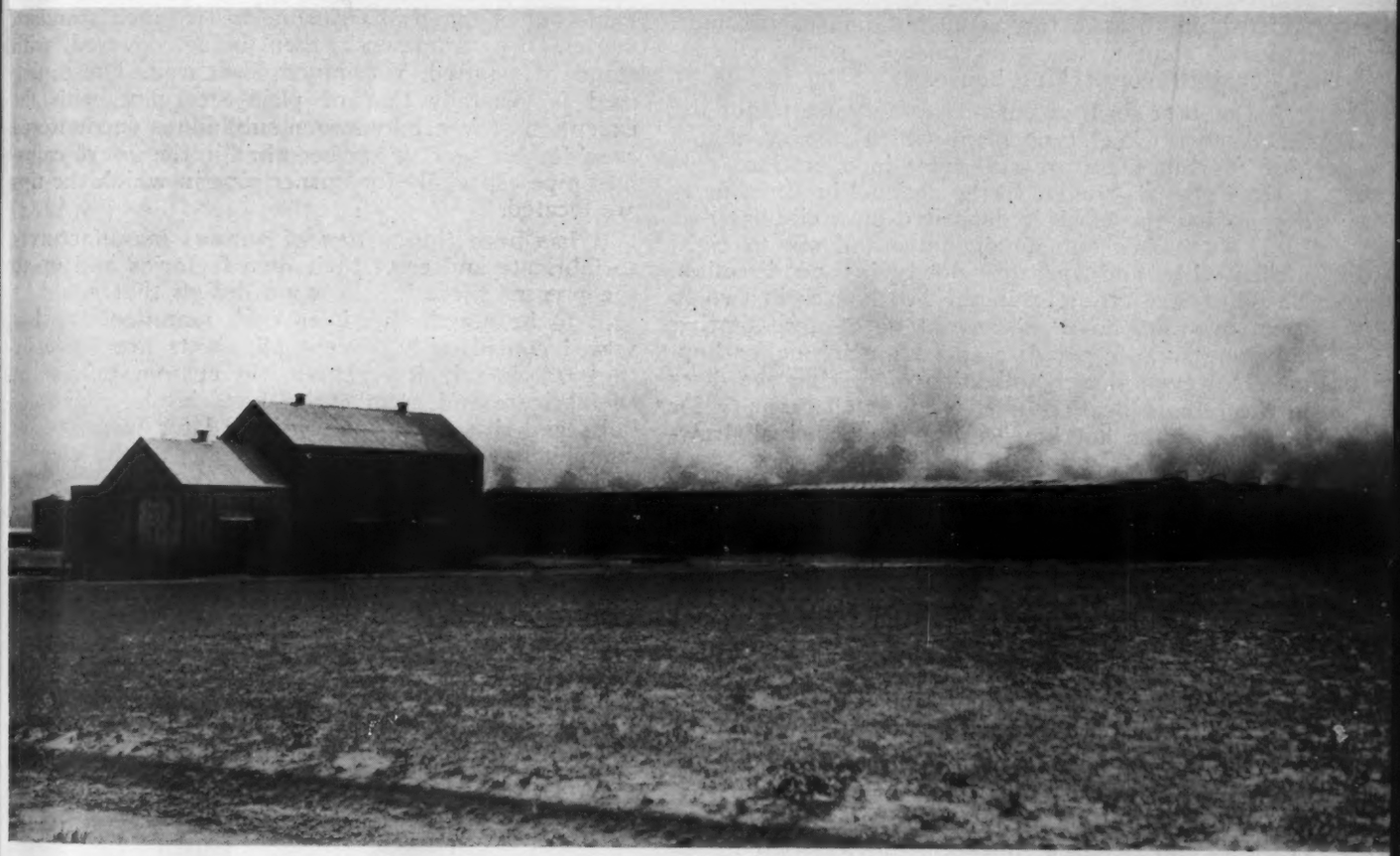
Carbon black producers built first in Texas in the vicinity of Breckenridge and shortly thereafter moved into the Texas Panhandle where, at present is produced approximately 76 percent of the total quantity manufactured in this country, or rather in the world, because, with the exception of small plants in Japan and Russia, the world's supply of carbon black comes from the United States. Carbon black has been produced in 13 states during the life of the industry. At present only Louisiana, Texas, Oklahoma and Wyoming have plants in operation.

Approximately 35 percent of all carbon black sold is exported. Under the stimulus of existing low prices, users are now loading black into their rubber stocks more heavily than heretofore and are to an increasing extent substituting carbon black for lamp black in ink and paint. It is to be hoped that such additional market outlets as have been developed during the recent period of disastrously low prices will not be lost when the price of carbon black has returned to a profitable figure.

During the past several years the average use of carbon black has been approximately 260,000,000 pounds, approximately 80 percent of which has been

used in the rubber industry. The value of this product has never exceeded $20,000,000.00, and at the current price and current rate of production, it can scarcely exceed one half of that.

The role of carbon black is familiar to many. Its value as a reinforcing pigment in rubber has saved hundreds of millions of dollars in the world's tire bill. Many are aware of the fact that the modern newspaper would be very expensive, if not impossible to accomplish, if it were not for the modern high speed printing press, the successful operation of which is dependent solely on the use of a free flowing, highly opaque, mixture of varnish and oil plus carbon black, called ink. Carbon black is the only known pigment which will provide sufficient opacity or hiding power in concentrations which are so small that the free flowing properties of the vehicle are preserved. Few manufactured products are so indispensable to the industries in which they are used.



MANUFACTURE

In the manufacture of carbon black, or more technically speaking, channel gas black, the product is produced by the partial combustion of natural gas, the gas issuing from a tip or orifice within an all metal house having restricted supply of air, and the lazy flame produced striking a chilling plate, usually a channel, to which the freed carbon of the flame sticks and is there deposited.

Carbon black is always referred to as a product made from natural gas and should not be confused with lamp black which is the result of incomplete combustion of oil in which production the smoke is collected and deposited in large room settling chambers usually of brick construction, and the different grades are derived from the distance that these small particles of black are carried in air suspension from the source of combustion. Lamp black is used almost wholly as a pigment for color purposes, principally in paints and solid carbon compounds, and while it appears similar to that of carbon black, is, generally speaking, not an interchangeable pigment.

VARIOUS TYPES OF PLANTS

By far the largest quantity of carbon black is manufactured by what is termed the channel process. It is so-called from the fact that the gas, when burned from various types of lava tips, is projected against the under side of standard steel channels, either of seven or eight-inch widths, where the black is collected. These channels, within the burning houses, commonly called hot houses, are bolted together, forming a grid with the channel edges turned up and these are suspended by means of cross channels or angles across the ends of which are bolted or welded two angles, serving as the support of flanged wheels which run on a track and support this channel grid. The channel grid is then moved longitudinally in the hot house a distance of from four to eight feet, above the gas flames, which are stationary, and in the process of this reciprocating motion, hoppers and scrapers are so placed that the scrapers remove the surface deposit allowing it to fall within the hopper, and then by means of a screw conveyor it is automatically and continuously removed from the hot houses into a central alley where it is again picked up by a larger conveyor and conveyed to the bolting and packing houses.

Within the hot house and located between each collecting hopper are burner pipes, usually one or

one and one-fourth-inch, which lie approximately two and one half inches below the channels and parallel to them and have placed in this burner pipe, at a distance of approximately every four inches, an old fashioned lava burner tip, from which the gas issues and burns in a lazy flame and in an atmosphere of insufficient oxygen to form complete combustion.

For convenience of operation hot houses are placed in two rows with a space of from 15 to 20 feet wide between them called an alley. This alley contains the two collecting tubes for conveying the black to the packing house, also contains the drives necessary for the hot house conveyor screws, also the drives to operate racks and pinions which cause the channels to move back and forth within the hot houses. A few years ago a factory consisted of 20 houses, but in the last five years these have been stepped up to as many as 60 hot houses per unit, and with some factories several units combined conveying into one packing house.

As another form of channel factory we might list the disc or wheel type plant which is now almost obsolete, but there are still some in operation. This type of plant is similar to the channel in all respects except that the black is deposited on a circular disc 36 to 40 inches outside diameter and six to eight inches wide, and operates slowly in one direction. The discs are arranged in the hot houses in two to four rows and have the advantage of necessitating only one scraper per disc and a much smaller hopper. However, the complication of driving the discs in the intense heat, coupled with small capacity for the size of the hot houses, are the principal drawbacks.

A third type of factory is that in which round rollers are used on which the black is deposited and from which it is scraped, every roller usually being put above or in one enclosing hopper. Each hot house then contains a series of these roller combinations which are usually about 12 inches in diameter and four to six feet long, and have one to two rows of tips underneath them. The black produced in this type of factory has several peculiar characteristics, for which the demand is limited.

In addition to the three types of factories just mentioned there are four other types, namely, restricted combustion, continuous cracking, batch cracking and electrical cracking. The restricted combustion type operates by burning gas with an insufficient amount of air in a large furnace, usually about 12 feet in diameter and 20 feet high. The smoke from this furnace is then collected by means of either bag filtration or is thrown down by means of water sprays, the slug of which is then filter pressed, dried in an indirect rotary drier and broken down by grinding.

In continuous cracking raw gas is cracked by means of being subjected to reflected heat or by being passed over continuous flames without the addition of any air.

The batch cracking is that of heating up a checker work brick furnace by means of burning gas underneath the bricks until a temperature of about 2300°F. is reached, then raw gas is admitted at the top, allowed to flow down over the heated brick work, wherein the gas is cracked, producing hydrogen and carbon.

The electrical cracking method, which is yet in the experimental stages, has successfully cracked gas, but more successfully cracked oil, in the vapor or liquid state. If oil is used this is thrown down as a slug and must be filtered, pressed out of the oil, dried and ground.

The black made under these four last processes has characteristics peculiar to each method, but is not commercially in direct competition with the more common channel black.

CONSTRUCTION OF PLANTS

The materials of construction of practically all of the plants are derived from standard steel shapes, standard channels being used for the collecting surfaces and angles or channels used for supporting this collecting grid. The frame-work of the hot houses is made out of material with one to two-inch standard angles, this framework then being covered with standard, painted, V crimped sheet iron. The piping used is generally that of plain steel pipe, with the exception of where hydrogen sulphide is encountered considerable success has been had in the use of calorized pipe especially for burner pipe in which the tips are located.

It has been the custom of various manufacturers to fabricate and erect their own factories and up to the present there has been no design that could be said to be standardized, as each manufacturer has varied considerably, except all plants are basically the same in principle. It was the custom, originally, to fabricate and erect entire factories by means of bolts and rivets, but many of the later factories are completely welded, mostly by means of the electric arc.

In all of this construction considerable attention must be given to providing for expansion joints, as the temperature within the hot houses is usually around 400° F. at the floor, approximately 1000° F. around the channel grid and from 400 to 500° F. at the roof outlets. There have been many different plans used for drafting the factories to control the limited supply of air uniformly throughout the houses, some excess air must be provided to keep the temperature within operating limits.

GAS DISTRIBUTION

The gas distribution to provide each burner tip with a uniform pressure over a factory covering several acres presents an interesting problem and in general is handled in one of two ways. The first method employed was to reduce the field pressure by means of standard, weighted, reducing valves down to three or four pounds and this was passed into a large bell jar gasometer type regulator, in which the bell floats on water or oil. The floating of the bell was then used to control a butterfly valve, reducing the pressure to six or eight inches of water. This was then distributed to the factory through a loop of 10-inch pipe, joining in several places to a loop of eight-inch pipe going around each group of hot houses and into this eight-inch pipe were welded four-inch nipples with four-inch valves, controlling two runs of four-inch pipe the full length of each hot house, which served to distribute the gas to the burners, as well as form the support for the burning channels and operating mechanism. In this final distribution the gas

dropped from the gasometer pressure to a pressure of about 0.2 to 0.3 inches of water at the tips.

A second method of distribution is that of running a large gas main down the central alley between the burning houses and controlling the pressure in this line by means of weighted regulators to from one to 15 pounds and then by the use of a single four-inch pipe extending back through the center of the hot house, controlling the flow to each house by means of an individual flow meter and small riser pipes from this general distributing pipe to each burner section. Each method accomplishes the same results. The former method requiring a much larger investment, while the second method requires more supervision.

OPERATION AND HANDLING

The operation of the hot houses is continuous over long periods, except when necessary to close down for cleaning and repairing. This is done in individual houses and seldom is a factory down completely.

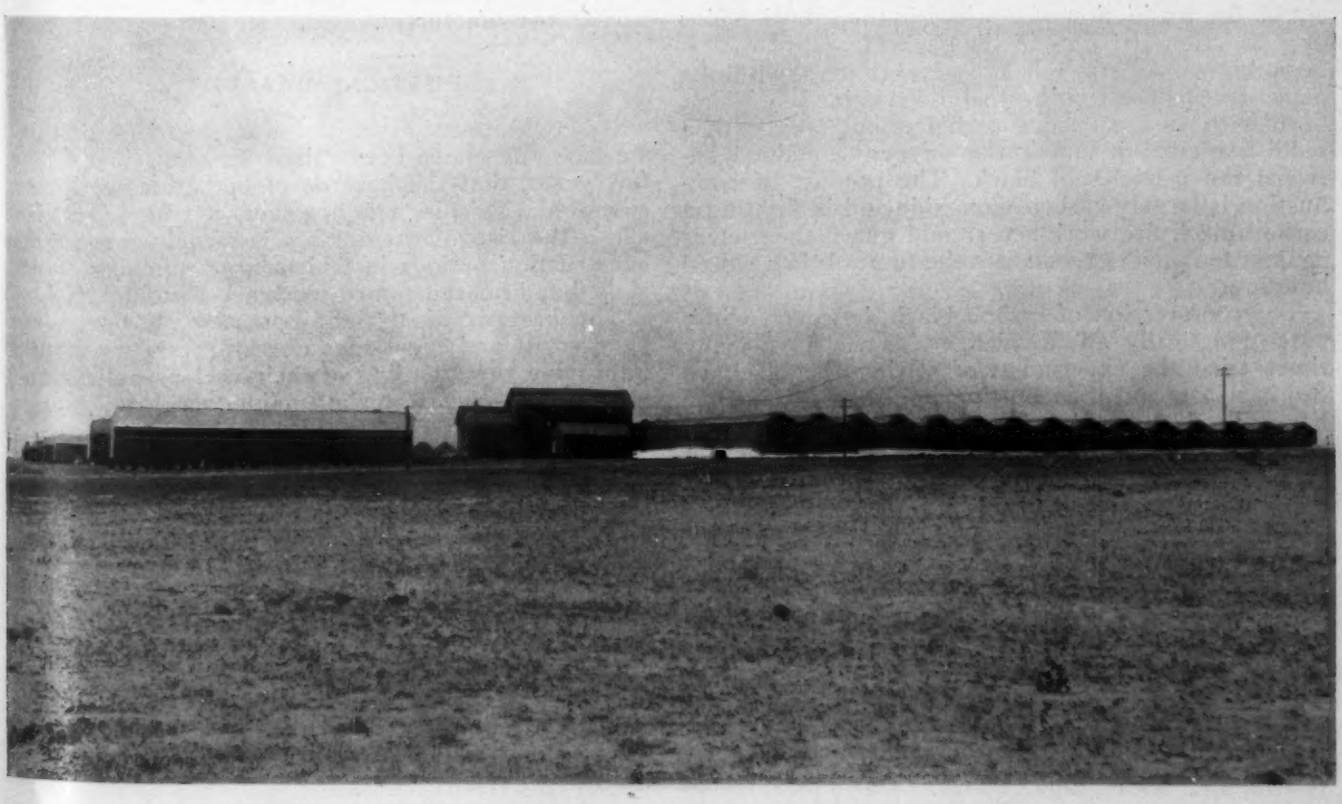
It may be of interest to learn how the lubrication of all of the moving parts is provided for, due to the high heats developed and due to much of the exposed machinery. Where the heat is high, that of the burner grid, no lubrication is necessary, as the burner grid support is carried on the axis of a large number of flanged bearing wheels, which themselves run upon a steel track. This gives rolling friction only, with very little wear resulting. The bearings in the alleys are either plain babbitt or roller type, the plain babbitt type usually lubricated by means of bottle or wick oilers and the roller type by means of compression grease. While carbon black seems to possess little or no lubricating properties, such as graphite, yet in its dry state it serves as a very effective lubricant for the bearings which support the many feet of screw conveyors necessary to handle the black.

As has been mentioned, the conveying of black is principally done by screw conveyors, which operate at comparatively low speeds, seldom ever over 30 r.p.m. and due to the slip back of this type of conveyor, it requires from two to three hours to convey the black from the furthest end of the nearest hot house into the packing bin. In handling black within the packing house this is done by means of vertical conveyor screws, inclined or vertical bucket elevators and by means of the air lift.

The black upon reaching the packing house is always bolted or sifted in various ways to eliminate foreign matter and break up the flakes formed on the channels. Bolting processes usually take one of the following forms: Brushing through a screen by rotating brushes; passing through an attrition mill where a highly revolving set of blades or bars break up the black and force it through a fine screen; blowing the black through a screen by the use of a fan or air blast and by air flotation.

The black, on being bolted, in one of the above forms, next is conveyed to a large bin in which it is agitated by various means to reduce its volume-weight relationship sufficient that it can be packed off in paper bags with a standard screw packer such as is used for sugar and flour.

As is well known, black is one of the lightest of our known pigments. In the state in which it comes from the hot houses it weighs about four pounds per cubic foot. Usually the bolting process further increases its volume to where it weighs but two or three pounds per cubic foot. Agitation within the bins then reduces this to about two pounds per cubic foot as it is packed off in bags for commercial use. Two sizes of packages are used, the smaller one containing 12½ pounds, requires a satchel bottom bag 17½ x 34 inches, and the larger siz bag is 22 x 38 inches, holding 25 pounds. If the black is to be used in the rubber industry it usually is compressed by means of mechanical plunger type presses or hydraulic presses to half the above volumes. This com-



pressing briquetts the black so that it is easier to handle and occasions less dusting in use. To minimize dusting in handling, the black is always overslipped, using a second bag slightly larger than the packing bag. In the case of compressed black this overslip is made small and is put on as the package comes from the press. Domestic shipments usually are made by stacking the black directly in a car after the car has been paper lined to reduce abrasive friction. Foreign shipments, however, usually are made in wooden or fiberboard cases containing from 150 to 325 pounds net each.

A recent development in the processing and handling of black has been to produce what is commonly known as dustless black. Black is taken either from the bolters directly, or from the agitating bins, and processed in such a manner as to produce spherical or granular pellets of a size which will pass through a 20-mesh screen, but will be retained on from a 65 to a 100-mesh screen. These small pellets are agglomerated carbon black in which each partical has been compressed in the treating process such as to adhere together sufficiently that the product can be handled in bulk with little break-down forming dust. This product has the same volume weight as the hydraulically or mechanically compressed carbon black, and finds its use principally in rubber. It has the further advantage that while a great deal of it is still packed for shipment in bags, yet it lends itself readily to being conveyed by standard conveying machinery which enables it to be shipped in bulk in tank cars, and handled in the receiving plants in dustless systems, resulting in cleaner processing and minimizing labor of handling.

The question is often asked regarding the inflammability and fire hazard in the handling of black. It would appear to some that the black would, in all probability, be explosive and dust explosions would result. However, there has been no record of such a thing happening. Carbon black being composed entirely of pure carbon, will burn, and is often times set on fire by friction of bearings in the agitation bins or by friction of flights in the packers, and black has been known to stay on fire several days within a paper bag before coming to the surface. It will not burn with an open flame or blaze, but only with a reddish glow consuming the oxygen contained between the particles of black. The product of combustion is largely carbon monoxide and in fighting a carbon black fire workmen should guard themselves against too much exposure to the fumes if in a closed building.

The compression of carbon black, however, eliminates practically all fire danger, as we have many times tried the experiment of setting the black on fire in a bag and then putting it in a press and we have found that this always extinguishes it completely, so that storage black in general presents a very small fire hazard.

TESTING OF BLACK

Carbon black is subject to several rather rigid tests, depending upon the use to which it is put. Due to the fact that factories are constructed mechanically different, operate with a variety of different kinds of tips under different tip height distances and amounts of gas, coupled with the fact that gases themselves vary as to different fields and different sources of supply within the fields, black varies a good deal in its physical characteristics and we are gradually developing better and more accurate testing procedures to be able to evaluate the various grades.

Practically all grades are subjected to a residue or grit test. The present standard for rubber blacks in this are that a black should not contain more than 0.001 percent of residue when washed through a screen of 325 meshes to the inch, which screen has openings of only 17/10,000ths of an inch.

In pigment work, color and flow are given primary consideration. If it is to be used for a lacquer or varnish it is evaluated on the intensity of true color, while if it is to be used in a body pigment, then it is considered on a basis of tintorial strength. It is interesting to note that practically all blacks, which when wetted with oil or clear varnish show up as intensely black are correspondingly weak tintorially, while a brown or gray black is usually fairly high in pigmentation.

The flow of black refers to its ability to absorb and hold in suspension varying quantities of mineral oil or varnish and is an index of its usability in the printing and paint trades.

Since the larger percentage of black goes to the rubber industry, the test for its characteristics when milled into rubber are probably the most elaboate. Practically all of the companies manufacturing black now are equipped with complete rubber testing laboratories in which a certain amount of black is ground on a rubber mill into crude rubber and other ingredients according to several test recipes. This stock is then sheeted out and placed in molds and vulcanized for various lengths of time, from 10 to 90 minutes. From these sheets, which are approximately 1/10th of an inch thick, is cut out a dumb bell, which is stretched to its breaking point on a Goodyear or Scott tensile machine and from this test, coupled with the standard tear test, abrasive test and penetrometer test, various blacks can be selected to fit into the requirements of the several rubber manufacturers.

PHYSICAL HAZARDS

It would seem, from the way compensation insurance rates have been raised in Texas in the last few years, that the hazards of operation were considerable. This is not, however, a true index, because the rise of these rates is largely due to the construction periods in which large numbers of unskilled and unaccustomed workmen are employed.

The hazards of straight operation, however, are very small and most manufacturers are constantly improving the guarding of their various pulleys and shafting so as to make major accidents almost negligible.

By those unaccustomed to the manufacture of black, and at first seeing the workmen almost covered with it, the question is usually asked if it is not injurious to health. There have been a good many men, however, employed constantly for a period of 10 years in packing black, wherein the dust is probably the worst, with no detrimental physical effects noticed.

It is true that some is inhaled into the lungs, but due to the fact that carbon black is not abrasive and is perfectly inert. there have been practically no known cases of it being detrimental to ones general health.

NO SMOKING
NO OPEN FLAMES
PERMITTED WITHIN 100 FEET OF DERRICKS, TANKS, SUMPS, GASOLINE OR COMPRESSOR PLANTS, OR ANY OTHER PLACE WHERE OIL OR GAS MAY BE PRESENT.
THE TEXAS COMPANY
KEEP OUT
KEEP GATE LOCKED

Cast iron ring for locked gates. The extension from the ring is easily broken by hand, allowing the ring to fall and the gates to swing free. This permits the operator of the plant to leave in an emergency without having to unlock the gate.

Safety Methods and Appliances in Gasoline Plant Operations

N. C. WELLS

Gas Engineer, Production Dept., Gasoline Division, The Texas Company (California)

Presented before the California Natural Gasoline Association.

MUCH has been said and done about safety. Probably too much has been said and too little done. In the construction and operation of boilers, safety codes have been adopted. They have been very strict and if anything too conservative. Consequently, we still have the recognition of welded boiler construction in the frying-pan. Properly constructed welded boilers have many advantages over the riveted type and will, no doubt, supercede them. Yet the boiler codes are slow to adopt the change. This conservatism has not reached the complete gasoline plant, by reason of the fact that the conditions laid down for ultra-safe design and operation of boilers cannot be met by the operators of certain other equipment without excessive loss of money. A spare boiler is like a spare pump that may be overhauled at our earliest convenience. Shutting down our one and only distillation unit for a minor repair job involves a fire hazard and loss of production.

The result has been relatively proper care of boilers, air tanks and other equipment covered by codes, and neglect of equipment in gasoline plants that is not so covered.

Then, a sudden disaster in the absorption plant proper, and inevitably will follow the promulgation of measures to protect life and property under codes similar to those applied to boilers and air tanks. However, the gasoline plant has many pressure vessels that cannot be shut down periodically without considerable loss of money. We have spare boilers, spare compressors and spare pumps. Why not a spare distillation unit?

The cost of a spare boiler, compressor or pump, is a small part of the cost of the main unit, whereas, the cost of building a spare distillation unit is double the cost of the necessary equipment. The answer

lies in precaution as to design, operation and personnel in order to safely operate equipment that cannot be shut down for regular inspection as well as for equipment that can. Consequently, the safe design and operation of the gasoline plant places more responsibility upon the designer and operator than is placed upon the designer and operator of the conventional power plant.

The safety methods and appliances presented herewith are particularly applicable to gasoline plant operations. The equipment involved in these operations requires special consideration in each case, from the conservative boiler plant to the latest fall styles in distillation units equipped with air-flow cooling towers.

THE BOILER PLANT

The location of the boiler plant is of great importance. It is true that gas and vapors should not be allowed to escape, but as a secondary measure of protection, the sources of igniting them should be considered. The boiler plant, with its draft attracting the flow of vapors in its vicinity, should be located at a safe distance from the absorption plant, and with reference to the prevailing wind.

The three-way fuel valve should be vented outside the boiler room at a safe point. Also, this valve should be located so that the operator may shut the fuel off without danger to himself in case of a tube blowing out or some such occurrence.

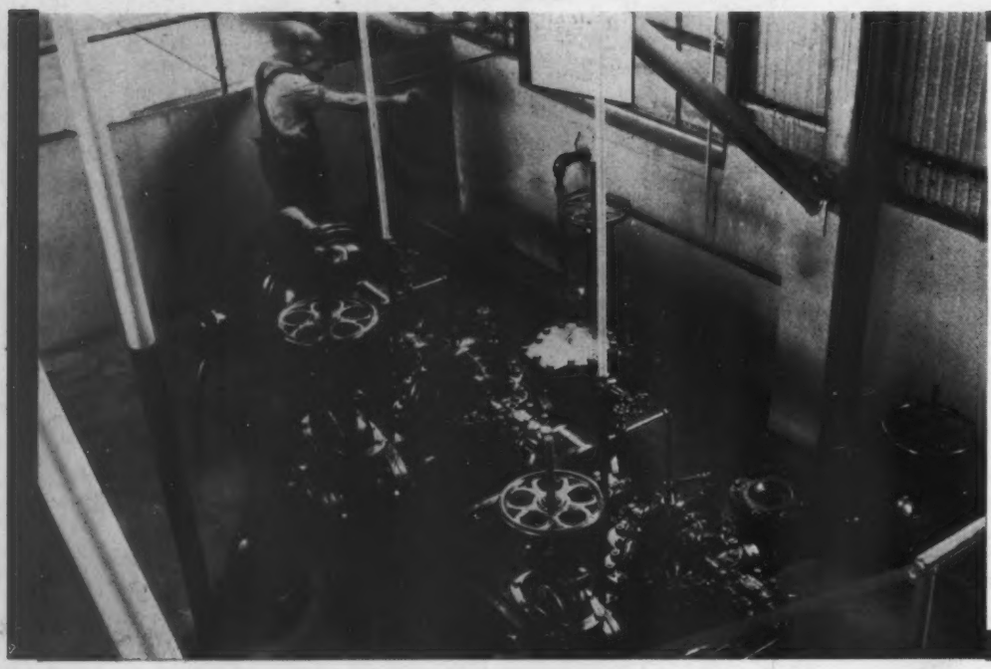
In this connection, it is advisable to provide a quick closing valve or plug cock on the main fuel line outside the boiler room so that the operator may shut down the whole boiler plant without serious damage to the equipment in case the boiler room should become flooded with steam from a break in the system.

Many plants provide means of flooding the boiler room with steam by installing a quick opening valve located outside the building. In case the approach of vapors or gas is discovered by the operator, he may shut off the fuel and, without closing the damper of each boiler, he may flood the boiler room with steam and thus drive the vapors from the fire boxes as well as provide means of preventing flame propagation.

In many cases provision is made to flood the fire boxes of the boilers with steam or water. Connections from the water drums may be tied into the fuel line and controlled by a quick opening valve. Tests have shown that the effect of suddenly flooding the fire boxes in this manner is not injurious to well constructed brick work and baffles. The ignition of vapors is prevented not only by reversal of the draft, but by cooling of the fire boxes.

Each boiler should be provided with means of steaming the fire box before lighting, even though three-way cocks are provided in the fuel line. This is mainly a precaution against the "human element."

The lighting of a boiler requires care. In some cases the operator has tried to light a second burner from the first. A lighter should be applied to each burner where double burners are used. Just as in lighting a heater at home, each burner should be lit with a very small flame before turning the gas on full. Even more than the "green" operator, the man who has fired oil burners should be cautioned about gas.



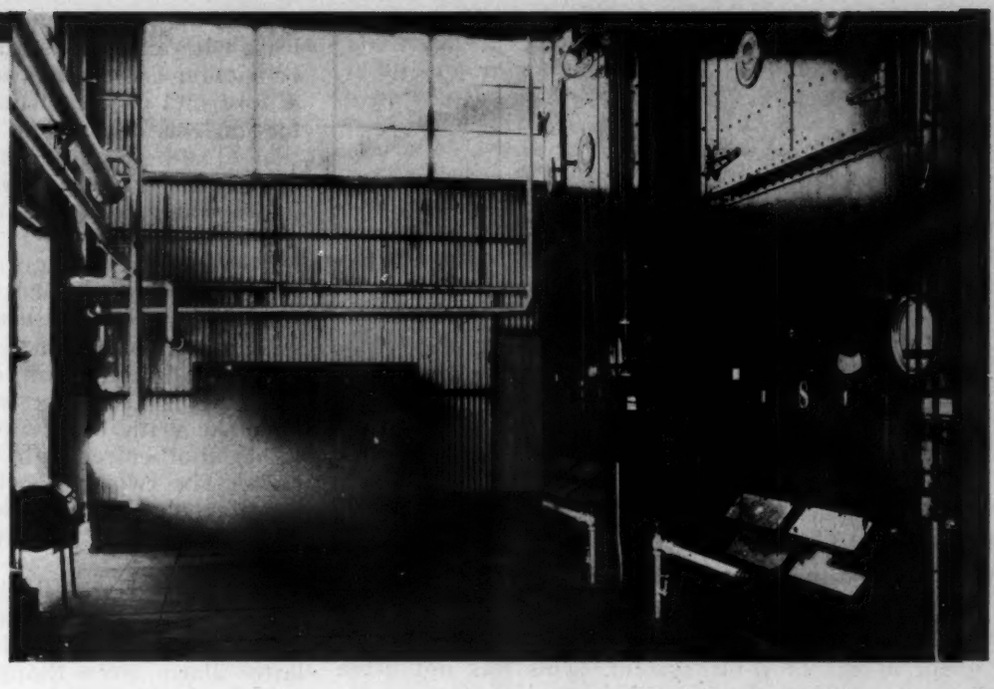
Reducing the pressure on the automatic switch control line starts the motor. Vacuum connections are shown on the intakes and pump casings to assure priming of the pumps automatically.

The type of lighter provided should receive careful attention. One arrangement provides for a connection to the fuel line of the next boiler and is lighted therefrom. If there is no fire under the next boiler, there are other methods of touching off the lighter that are safe.

Most insurance companies, in conjunction with the state, require rigid inspection of boilers. This is as it should be. The visits of these inspectors should be welcomed by the operators. Their advice is invaluable.

Necessary repairs should be noted by the operator and pointed out to the repair men at the following shut-down. Notes should be made in writing of repairs required as well as those accomplished.

The proper type of safety valve will require very little repair work. In cases where relief valves give



After shutting off the main fuel line, a plug cock outside the building may be opened to flood the room with steam. This is to prevent igniting vapors from the fireboxes.

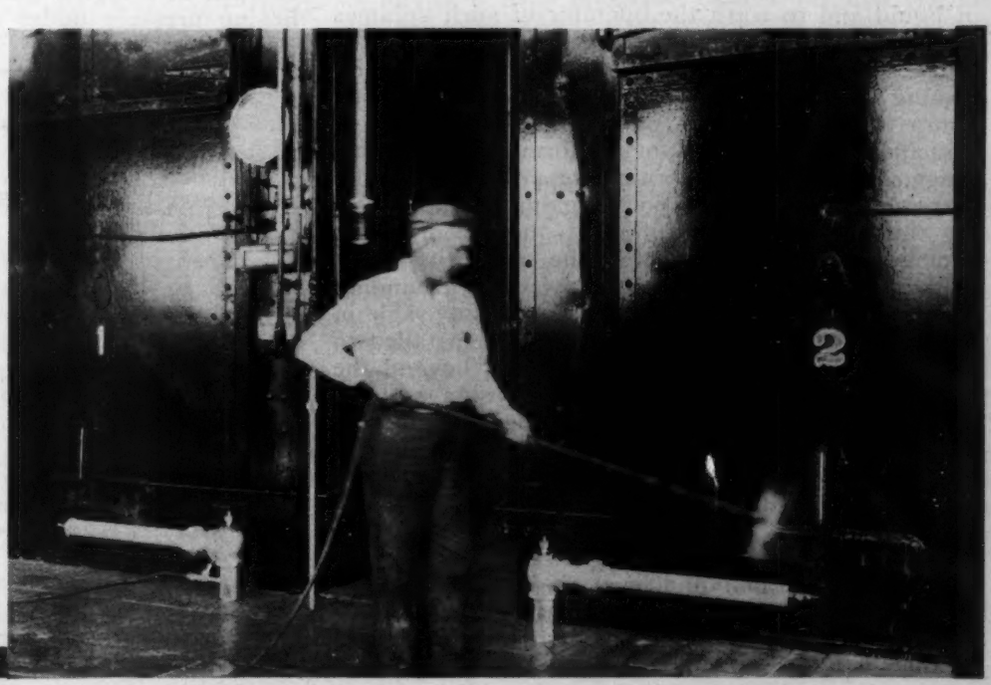
much trouble, a test is recommended before shutting the boiler down and immediately after firing it up to full pressure. In other cases the latter test will suffice. Usually the valve is lifted manually before the test. Naturally, the boiler should not be left on the line with a faulty safety relief valve.

High and low water level alarms should be checked in the same manner and necessary repairs made. To assure repairs being made when there is any question about the condition of the boiler, the plant should be designed for an extra boiler that may be spared at any time without loss of production.

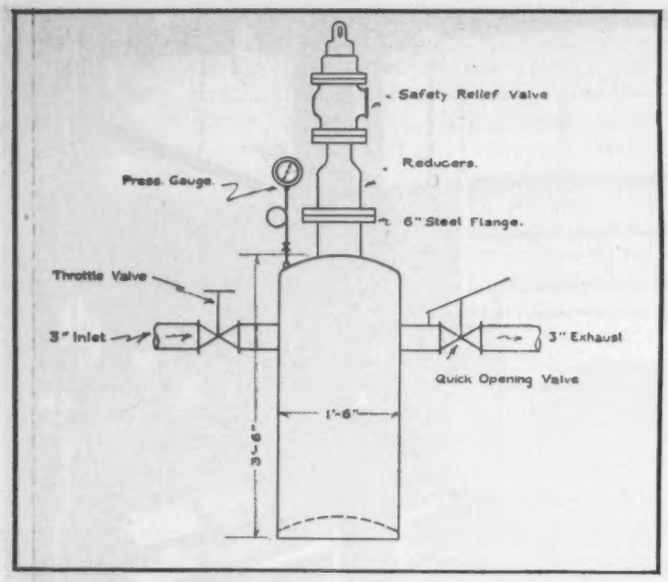
Conditioning the feed water for safe operation is a subject that has been treated at great length. Suffice it to say here that frequent routine tests should be run by the operator to determine hardness of the feed water and concentration in the boilers. Laboratory tests should be run to determine the possibility of caustic embrittlement and to check the routine tests for hardness.

The routine of the operator should call for frequent inspection of tubes and fire walls. A more thorough check on the condition of fire walls should be made by the repair men and this inspection should extend to baffles, tube sheets, etc.

It is an erroneous belief that blow-down lines are never subjected to high pressures. In most cases the pressure drop between the boiler and the blow-off box is considerable. Even where this is not normally so, the line may become scaled up at some point and occasion the same result. Consequently it is advisable to use extra-heavy pipe and fittings on such construction. Also, plenty of space should be provided so that an operator or repair man will have room to avoid escaping steam in case of a sudden



A safe type of lighter is a homemade burned with a jet to draw in air and a plate close to the end to flare the flame. It is lighted from boiler No. 1 and then applied to boiler No. 2 through one of the holes in the burner.



Portable outfit for testing safety relief valves.

break in the blow-off system. This has not often been done where boilers are housed in.

Proper deaeration of feed water is conducive to safe operation of boilers, steam lines and pumps by reason of the fact that it will reduce corrosion and leakage. To further reduce leakage in steam lines, expansion joints or loops are used. Even in low pressure steam and return condensate lines, the use of extra-heavy fittings and welded construction is advisable and will, in most cases, pay out in a short time by the saving in maintenance cost.

THE COMPRESSOR PLANT

Intake lines should be provided with means of properly scrubbing the gas at all times. One very satisfactory arrangement consists of a large by-passed scrubber, followed by a more efficient scrubber for the removal of mist entrainment. The large scrubber is equipped with an automatic dump trap, a steam pump and a liquid level alarm. This scrubber is provided to handle irregular large volumes of liquid and to warn the operator of such volumes as the trap can not handle.

The second scrubber is to remove the steadily incoming mist. It, too, is provided with an automatic dump trap and a steam pump. The latter is used principally as a stand-by for the former. Such an arrangement has provided complete protection, under extremely adverse conditions, against liquid entering the compressors in sufficient quantity to cause damage, or to noticeably affect the lubricating oil.

In many cases an automatic device for grounding the engines is used. This is particularly advisable in the case of recompressors. It should be installed to operate when the liquid rises to a point beyond the automatic alarm float. The proper design and installation of this equipment should be carefully undertaken. It also provides for means of grounding the engines from a safe distance by hand control.

Drainage facilities for scrubbers should be sufficient to drain at a rate equal to the greatest expected rate of liquid influx.

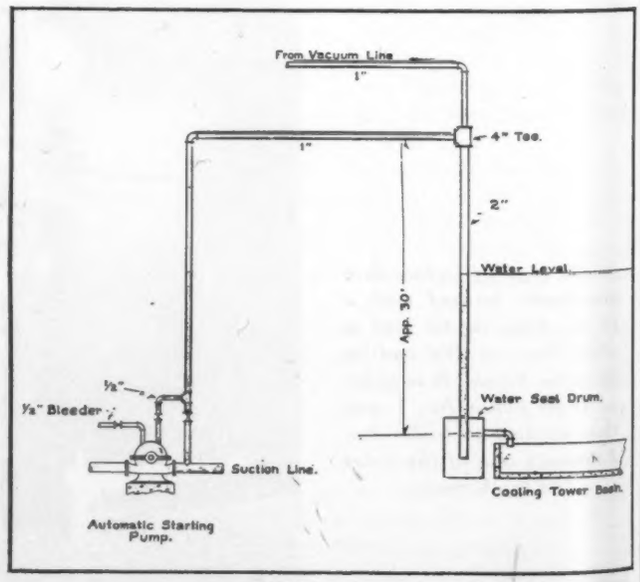
The best type of liquid level alarm is one that is simple in construction and easy to maintain. Conduits connected to it should be airtight and installed so that no gas can enter them at any point. One type of alarm that originally contained a trigger release with many consequent moving parts and points of friction has been revised to better serve the conditions met in gas scrubbing. The weighted trigger motion was changed to a direct connected float action. The best types are not infallible and should be tested daily by the operator. To facilitate this testing, a water connection is made into the bottom of the float chamber.

To enable the operator to calmly go about handling the situation occasioned by an alarm, each alarm is provided with a switch. This is a two-way switch that turns on a prominent red light when the alarm is turned off, thus reminding the operator to turn the alarm on when conditions are back to normal. With the switch on, action of the alarm lights another red light and sounds a motor-driven horn. The two-way switch and the two red lights serve an obvious purpose where a plant is equipped with more than one alarm tended by a single operator.

Without this switch the operator might be pumping out a scrubber when the jacket water pressure alarm sounds. He might not be able to hear this latter alarm, even though the scrubber situation is well in hand. With a one-way switch, he might forget to turn the scrubber alarm on after pumping out the scrubber. With no switch at all he might become completely distracted with the constant sounding of horns telling him what to do when he can do only one thing at a time.

As an additional precaution against damage due to liquid entering the compressor, small sized cylinders often are provided with spring-loaded valves, and occasionally, in the single acting type, with spring-loaded heads.

Safety relief valves on compressor cylinders have been universally used and generally installed in proper manner. Testing and repairing these safety valves is a simple matter where a unit may be shut down for a short time. Testing may even be accomplished without shutting down by raising the discharge pressure. The temperature of the discharge gas usually is such that these valves are set to open at a higher cold test pressure than the relieving pressure under operating conditions. A pe-



Priming device for automatic pump.

culiar action may result from this phenomenon. Safety relief valves are usually piped outside the compressor building and thus may become comparatively cool until put into action. Once warmed up by relieving hot gas it will require lowering of the discharge pressure below the original point of relief to stop its action. After cooling off again it will function at the required pressure.

In addition to hand controlled and automatic grounding devices, a plug cock should be provided for remote control of the fuel. Plug cocks in this and many other services permit rapid and complete stoppage of flow.

Compressors should be operated with maximum speed governing at all times. The most constant load conditions may be radically upset by failure in a line causing a sudden unloading of a compressor, consequently, no exceptions should be made to this rule and it should be rigidly enforced.

Inside air intakes have been known to allow engines to run away where release of gas in a poorly ventilated building furnishes fuel to the engines through these lines even after the governor has shut off the main fuel. On the other hand, outside air intakes without very efficient air filters will cause no end of trouble. The conclusion seems to be that inside air intakes in a well ventilated building have never been known to cause any trouble, but no harm has been done in either case by installing good air filters.

Starting air should be thoroughly scrubbed. Water in starting air is not conducive to quick starting and accumulations of lube oil are conducive to explosion. It is well, therefore, to drain air tanks daily and to provide for proper drainage of air lines.

One of the most economical methods of circulating jacket water in the gasoline plant is by means of a gas engine-driven pump with a motor-driven stand-by. The latter should be automatically cut in by a reduction of jacket water pressure and this should involve an alarm to notify the operator of the condition. Where a vacuum line is convenient, an automatic priming device may be used on the stand-by pump. This device is secondary to installing all water pumps so that a positive suction pressure is provided. The stand-by pumping system should be tested daily, including the alarm and priming.

Instructions regarding starting and stopping an engine are more or less standardized. Most operators, however, should be cautioned to disconnect and remove spark plugs immediately after shutting down an engine.

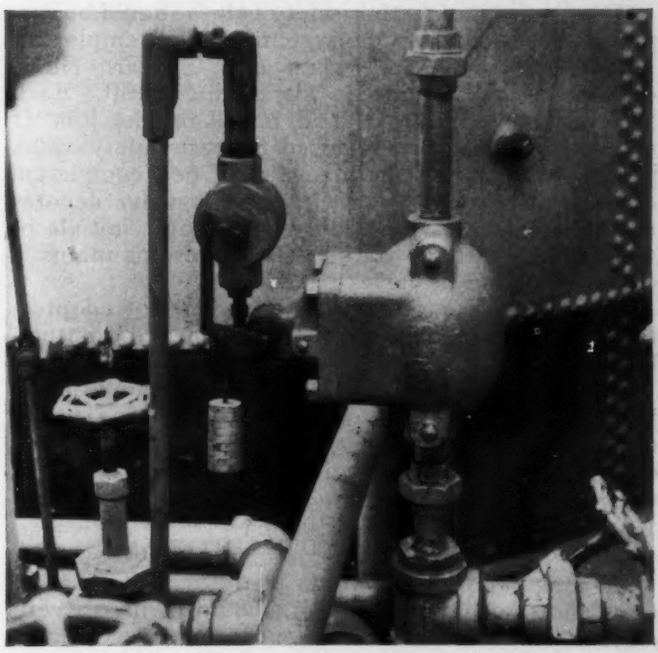
The location and layout of the complete plant is an important safety factor. Available land is the first consideration, but one site may be discarded for another depending upon prevailing wind, night wind, roads, power lines, surrounding property and its equipment, etc. Where several land sites are available, one engineer has suggested that copies of a plan view of the complete plant be made and then cut out and arranged on each plot of ground. Under such a scheme engineers could sit up nights playing checkers. Seriously, this is an excellent idea. In such planning, much consideration should be given the relative arrangement of the boiler plant, compresor plant, storage tanks, sumps, etc.

The design of unfired pressure vessels, heat transfer equipment and foundations has received much attention in recent years. As a result, we find few if any failures in this field of engineering.

Invariably, complete drawings of the original plant are available. Finished drawings, or at least sketches of all subsequent changes should be made. To secure a permanent record of all changes in flow, the engineering department should be furnished with a copy of each work order. This will enable it to keep its drawings, or at least sketches, up to date.

Pump houses and buildings containing flammable fluids should be well ventilated. In many cases this is accomplished by having gasoline and oil pumps housed merely with a roof.

Storage tanks containing finished product and other tanks and accumulators containing liquefied petroleum gas constitute the greatest hazard in the gasoline plant. The modern trend is toward metering the finished product and shipping it as it is produced. Of course this excellent method has a limited application, but could be used where pipe line shipments are possible. The consequent reduced shipping



Liquid-level alarm. A trigger release type has been converted to provide a direct connection between the float and the mercury tube, and also made vapor-proof. A water connection is provided for testing the alarm daily.

pressure would ordinarily reduce line losses as well as keep plant storage at a minimum.

Where storage tanks are used, much can be done to make them comparatively safe. They should each be equipped with adequate pressure and vacuum relief valves. In many cases a reducing pressure valve is located on the stream from the rectifier. At any rate, an overflow line should be provided to eliminate over-filling of the make tank. This line should constitute a balance line between all storage tanks and is often connected to a spare tank, never to be used as a regular storage tank. It should be so connected as to assure a vapor space in each tank at all times.

Recently, the use of frangible heads on storage tanks has received considerable attention. Their use must provide for piping of relieved gasoline or vapors to a safe point. Such a point should be equipped with a continually burning torch, but even in this case provision must be made to eliminate or properly care for the pressure of an explosion mixture in the blow-off line.

The storing of large quantities of raw gasoline has

many advantages from the standpoint of proper rectification. It will provide a fairly constant quality of feed. From a safety standpoint it is absolutely prohibitive.

It is not within the realm of this paper to discuss safety valve capacities and their blow-down pressures. However, all safety valve connections and all inter-connecting lines should be installed in such a manner that the operator can control the flow through them. A rising-stem gate valve should be installed ahead of each safety valve. To insure against improper use of these gate valves, they should be sealed open. To attract attention to their importance, the wheels of these gate valves should be painted red.

Boilers and compressors are usually an exception to this ruel because an individual unit may be, and censequently will be, shut down for regular inspection without loss of production and without danger from excessive venting of flammable fluid.

The program of testing safety valves should be carried out periodically. One system involves employing a tester to cover each plant once a year. He is equipped with a portable air testing outfit. Each safety valve is removed and tested on the job. If extensive repairs are required a spare safety valve is installed pending these repairs. Upon completion of the test, a metal tag on the safety valve denotes the relieving pressure, date of test and initials of tester. In addition to this, the tester maintains a complete record of valves tested.

If some such a system of testing is not adopted tests will be postponed for some reason, and eventually forgotten.

In the use of plug cocks, the designer should place himself in the position of an operator trying to secure a quick shut-off on a gasoline pump suction or discharge line, the drain line of a pressure vessel, the suction or discharge valve of a compressor, etc.

CONSTRUCTION AND MAINTENANCE

Construction of a gasoline plant as well as additions and sizeable repairs to it, should involve a very close liaison between the designers and the construction crew during their progress. An engineer, familiar with design, construction and operation, should have direct charge of the work. Skilled labor in all lines involved is essential. This includes pipe fitting, welding, rigging, asbestos work, brick work, carpentry, electrical work, etc.

Welding and pipe fitting should be carefully supervised. It is well to provide a pipe stretcher for connections that are made up too short. The operation of this device is as follows:

1. Discard the piece that is too short.
2. Make up a piece that fits.

Buried lines should be well protected before backfilling. Provision also should be made to allow for a reasonable amount of corrosion, particularly at the joints. Corrosion and reasonably hard usage of quarter-inch connections has led to the adoption of a rule that the minimum size of all connections up to and including the first valve should be half-inch. To avoid mistakes in repairs and construction, or in conversion of a line from a non-hazardous type of service to a hazardous type this should be made a universal rule. The popular use of quarter-inch connections has involved pump bleeders, pressure gauge lines and sampling connections. Thermometer wells should be made from at least three eighths-inch stock.

The operators should be provided with non-sparking gland wrenches and other such tools, as should the repair men.

Earthquake-proof construction is a subject in itself and will, therefore, be dealt with briefly. Connections to storage tanks should involve swivel joints that will absorb motion in any or all of the three directions. To prevent horizontal motion of guyed vertical pressure vessels, holes may be drilled through the base flanges and dowel pins anchored to the foundations through them. These holes provide a clearance around the dowel pins to allow slight tilting of the vessel without rupturing it.

To prevent dangerous swaying, self-supporting columns often are used, but in many cases the expense, compared to guying, is prohibitive.

OPERATING PERSONNEL

Breaking in new operators presents a problem. The type of man should be carefully considered. The prospective operator should have a certain amount of mechanical ability, yet many specialized mechanics make poor operators. With all the provision of sketches, drawings, instructions, etc., the ideal man is not completely broken in until he has experienced almost every difficulty that the particular plant has to offer. This being impossible of accomplishment in breaking in a new man, consideration should be given to his natural ability for mechanical work, his ability to understand and interpret orders, and above all his resourcefulness and ability to think for himself.

Specialization in each line of work, the boiler plant the compressor plant and the absorption plant, is seldom applied to each and every operator. Usually, some operators must be trained for relief in various departments. However, the value of specialized operators in each department should not be under-estimated. One man, a fireman by trade, in the boiler plant, will have a very definite influence upon the operator who fires boilers and relieves the absorption plant operator or the compressor plant operator. The value of such a specialized man might be underestimated when comparing him to the so-called "all around" man.

Particularly in the absorption plant proper, we have the problem of the clever versus the conscientious operator. The clever operator is one who offers intelligent suggestions for improvements and is likely to get the "big head" therefrom. The conscientious operator is one who is on the job all of the time and is never out taking a smoke, as the clever operator may be after doing a good job.

Standing orders concerning safety should be posted in a separate bulletin from other routine orders.

In most plants, date books are provided for notes by each operator, informing the relieving operators of regular and special duties performed, requests for material, etc. The plant foreman's entries in these books might well be made in a different color by using a red pencil. His instructions, as well as those provided in safety bulletins, are thus easily reviewed by the new operator.

Operators should be left on their own as far as it is safely practical. Results, rather than explanations of failure, should be reasonably demanded. Instead of constantly hounding the operators about their work, the foreman would do better to keep a constant check on the results and demand a high standard of safe and efficient operation.

Use of Ammonia

In Corrosion Prevention

J. W. SMITH
Superintendent, Berry Asphalt Company, Waterloo, Arkansas

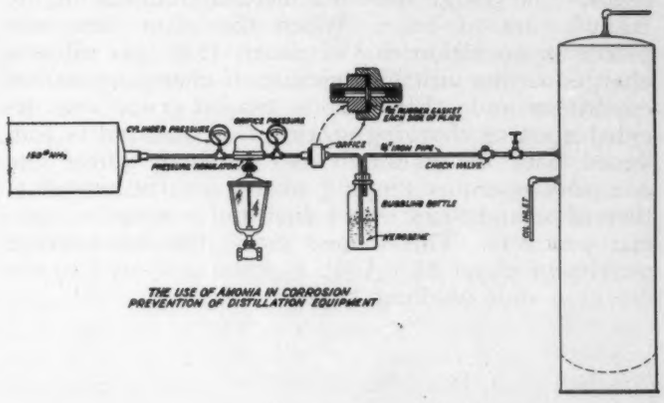
THIS article will deal, not with the theory and general methods of using ammonia as a corrosion retardant, but will discuss actual means of handling the ammonia as found mainly by experience at our refinery.

The material is received in steel drums weighing approximately 395 pounds and containing 150 pounds anhydrous ammonia, a liquid under the cylinder pressure of 300 pounds at normal temperature, but which returns to vapor as the pressure is released. From perusal of the literature it was found that practice in introducing ammonia was by hand control of the flow by means of a needle valve, with or without a manometer indicating the rate of flow. Since the pressure on the high side of the valve varies both as the quantity in the cylinder and as the air temperature varies, it was believed some automatic means of control would be desirable and which would not require the changing by hand of the valve opening as cylinder pressure lowered, or as temperature conditions varied.

With this in mind a diaphragm operated, single seated needle pointed pressure regulating valve was obtained, with which a reduced pressure of from one to 15 pounds per square inch could be maintained, and this valve was placed in the ammonia feed line, which was made up of quarter-inch iron pipe originally. It was immediately found that this was not sensitive to small changes in pressure as one inch of water head was sufficient to enormously increase the ammonia flow.

A small orifice plate then was installed past the regulator, and after varying the size of orifice several times, it was found that an orifice of 0.02-inch diameter caused an appreciable pressure drop across it under a flow of one half to one pound ammonia per hour, thus giving very satisfactory regulation. However, such a small orifice plugs up very easily so it was found desirable to have a visual record of actual operation of ammonia. Before purchasing a high pressure bubbling chamber, an ordinary one-quart screw cap bottle such as used in storing medicines was tested to destruction. Much to the surprise of the experimenters it required 200 pounds pressure to break the bottle, so one was immediately installed as a bubbling chamber.

Corrosion of the equipment being damaged began on the lower shell of a crude oil to vapor heat exchanger, and continued from this point to storage, being severe enough to require rebuilding the vapor lines about once each three months. It was decided to introduce ammonia above the exchanger, and connection was made into the vapor line at this point. Equipment loss immediately was reduced to a satisfactory point by maintenance of a pH of 7.0 when ammonia was introduced at the vapor line. However, ammonia odor was strong in rundown tanks,



THE USE OF AMONIA IN CORROSION PREVENTION OF DISTILLATION EQUIPMENT

indicating excess ammonia was being used. The point of introduction was then changed to introduce the ammonia into the bubble tower above the flash point which reduced the odor about the rundown tanks to practically none. No trouble has been experienced with salting of bubble trays.

For control purposes, a daily sample is taken from the water stream coming over with the overhead cut and is maintained at 7.0/7.2. Initially this was determined by titration against phenolphthalein, but since the endpoint on phenolphthalein is 8.0, unsatisfactory results were obtained. Titration was then continued with bromthymol blue and cresol red as indicators which was reasonable satisfactory. However, it was found much quicker, as well as more accurate, to use a Hellige tester so that control of ammonia is now maintained by means of this instrument using bromthymol blue color plate and indicator.

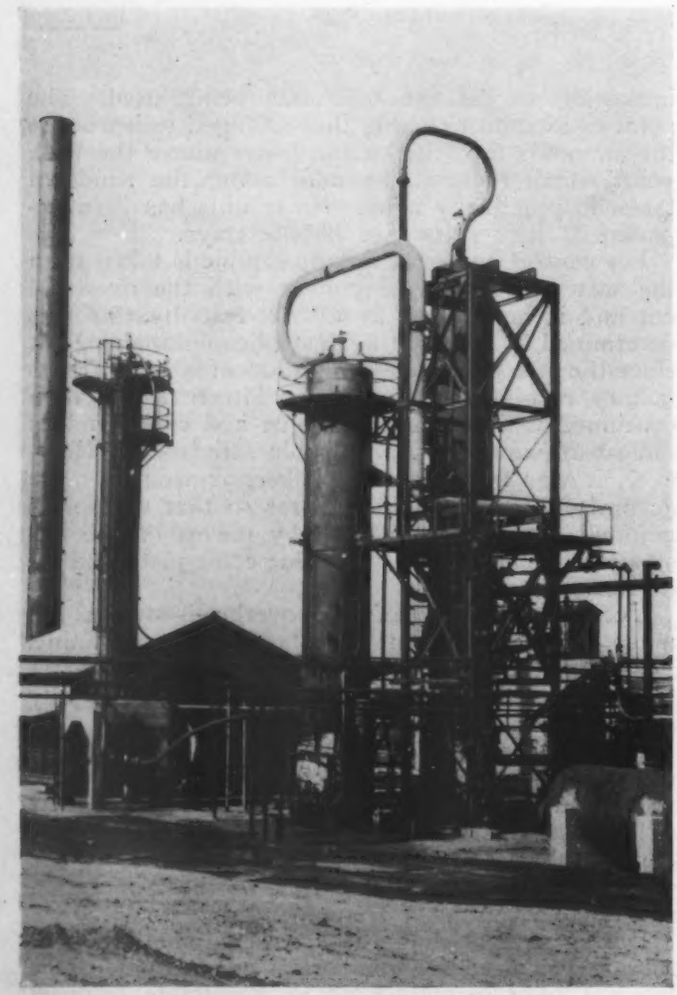
Occasionally tests of the overhead stream are made for iron by means of potassium ferro cyanide. A few drops of this solution when poured into water from the overhead stream will show blue when only a trace of iron is present.

pH on the overhead water of less than 7.0 will sometimes result in slight corrosion as shown by the potassium ferro cyanide test. pH greater than 7.2 will cause corrosion of brass and admiralty condenser tubes, and at the same time results in the use of excess ammonia, so that for best operation pH 7.0 to 7.2 is most recommended.

During several changes of the equipment, copper tubing was used for temporary connections. This has not been recommended as a suitable material for ammonia piping, but has stood up well for the past year without evidence of weakening.

Cracking
Topped Crude at Cushing

CUSHING Refining & Gasoline Company's new Dubbs cracking unit at Cushing, Oklahoma, was designed for processing either gas oil or topped crude. The design does not include facilities for the manufacture of coke. When the plant first was placed in operation in December, 1934, gas oil was charged to the unit but because of changing market conditions and other factors, topped crude was decided upon as charging stock. This material is produced both at Blackwell and Cushing where the company operates topping plants for the manufacture of straight-run motor fuel and a range of special products. The topped crude has an average gravity of about 25.5 A. P. I. when delivered to the cracking unit working tanks.



Dubbs cracking unit, Cushing Refining & Gasoline Company, Cushing, Oklahoma.

The topping operations of the two plants at Blackwell and Cushing are similar to those used in other Mid-Continent refineries producing motor fuel, kerosene, gas oil and fuel oil. The residue from the skimming plants is cooled and shipped by pipe line or tank car to the cracking plant. It is charged to the cracking unit by way of the vapor recovery plant. This is not yet common practice and the system is somewhat unusual in that the topped crude is used as an absorption medium instead of mineral seal oil or other light distillate.

Topped crude has not been considered as a very efficient absorbing medium for light petroleum vapors, but when used in large volumes the same results can be obtained as from a special cut. Because of the fact that the topped crude has a sufficiently low temperature, and that the entire cracking and vapor recovery plant was designed in this manner the topped crude travels only once through the system. It is picked up by a charging pump and delivered to the vapor absorber in the same manner as that followed in mineral seal procedure. It is then taken from the base of the column through a second pump which delivers it to the fractionating, or bubble column in the cracking unit. No distillation is attempted at the vapor recovery plant, and as a vapor recovery plant, the only operation carried out there in this respect is that of absorbing the gasoline fraction from the gases coming from the cracking plant.

The enriched topped crude from the base of the absorber is delivered to a port in the side of the bubble column where it is stripped of gasoline as it travels downward to mingle with the material coming from the cracking coils. These light vapors taken from the gas are removed from the bubble tower together with the vapors made by cracking.

A hot oil pump takes suction on the base of the bubble column and charges both the stripped topped crude and the recycle material to the cracking furnace. This furnace is a double fired unit, containing several coils, placed in the walls, the floor, as floor tubes, and in the sloping roof. It was built with air cooled walls, also uses interlocking refractory material in the bridge wall which is self suspended. Its capacity is about 29,000,000 B.t.u.'s per hour, and employs carborundum tunnels in the combustion sections.

The crude and recycle material enters the furnace at a temperature of about 620 °F and at a pressure of about 400 pounds. The charge follows through the various banks of coils, cracking, soaking and floor tubes with the furnace temperature maximum, as shown by the thermocouples, of about 1450 °F. The cross-over temperature is carried at between 890 and 895°F, and the transfer temperature

is about 930 °F. The transfer pressure is about 260 pounds as the cracked material enters the reaction chamber of the plant.

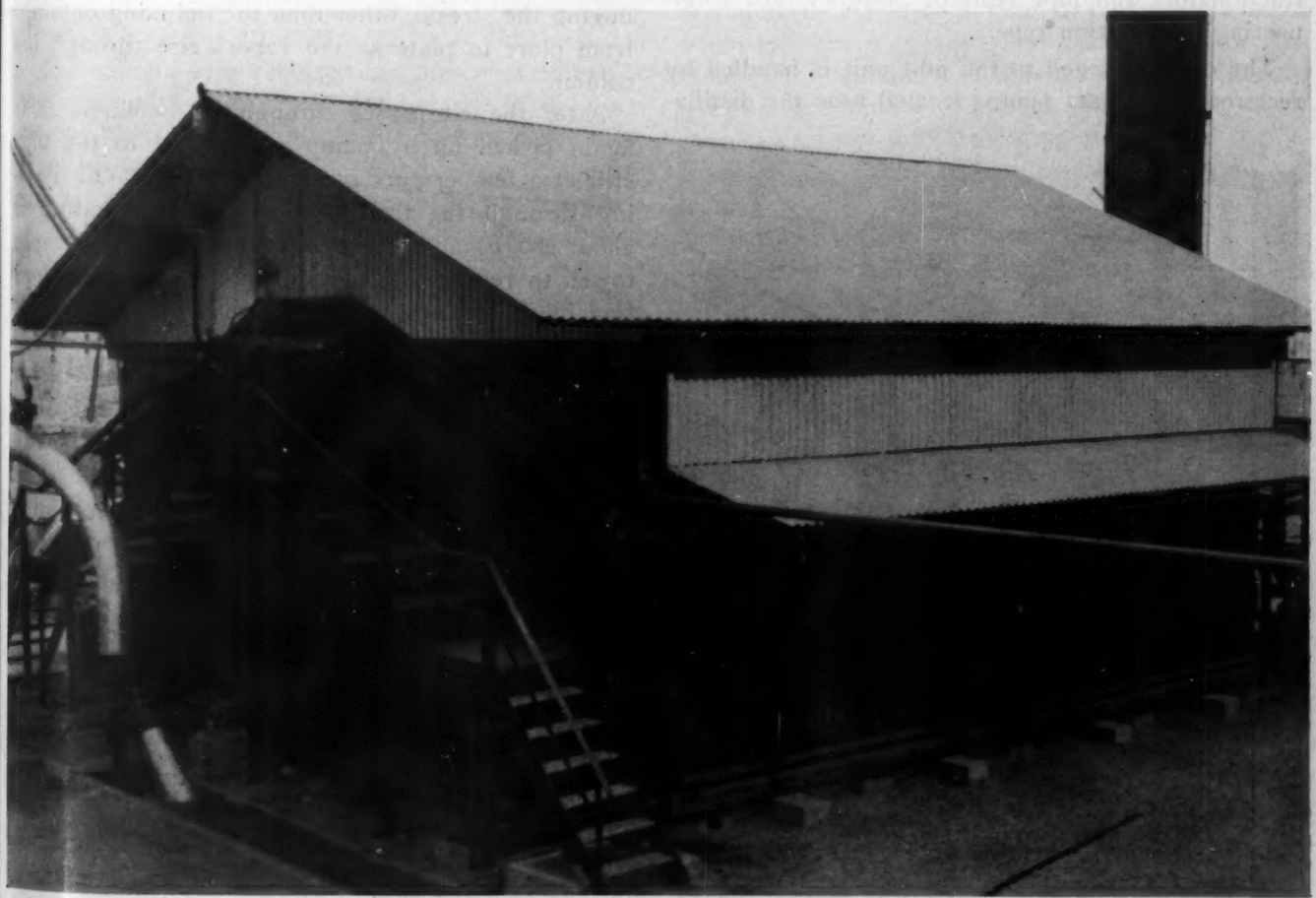
The flywheel hot oil pump is controlled with the usual belt driven governor, and has as an added controller, an instrument placed in the steam line leading to the pump. The recorder and the instrument which holds the controller at the desired opening in the steam line is placed in an auxiliary room adjacent to the pump, and not on the main control panel in the pump room. A constant speed is obtained through the use of the two governing units. As the oil leaves the transfer line, it enters the reaction chamber through the top head through an insulated pipe line. Gas and liquids leave this unit at the base and immediately enter the vapor flash column where all the liquids are removed from the charge. Residuum is taken from the base of the vapor flash column and passed through coolers and to storage from which it is subsequently pumped to tank cars for shipment. This residuum, or fuel oil has a gravity of about 8° A. P. I. The viscosity averages 150-200, with a flash point of about 250°F. The b.s. and solids do not average above three tenths of one percent. As the flash is low and the pour point around 15°F, this type of fuel oil is in constant demand and constitutes an easily disposed of product from cracking topped crude.

The volatile fractions separated from the cracking charge as it passes through the vapor flash column are led to the bubble column where all the non-essentials are removed before the pressure distillate vapors are taken from the overhead connection. The top of the vapor fractionator is controlled by wet reflux which is pumped over it from the pressure distillate receiving drum. To secure the desired fractionation, the top of the column is maintained at 375 °F.

Capacity of the plant is about 1800 barrels daily, and the yield from this charge is about 55 percent of finished pressure distillate. By operating the plant as it is, there is no necessity of blending for end point or volatility. Distillation of the pressure distillate shows an initial boiling point of about 93 °F. and an end point of about 393 °F. with no "tails" at either end of the graph. It forms a straight line when plotted on a distillation sheet and follows a ruled line from the initial boiling point to the end point.

The distillate after condensation is received in the accumulator drum from which it is passed to the pressure distillate stabilizer where the vapor pressure is reduced to that desired for the particular season in which it is to be shipped. Gases from the top of the fractionator are condensed sufficiently to produce reflux for the column and the excess burned in the cracking furnace. The stabilized gasoline is inhibited so that gums are not formed and treated to sweeten with sodium plumbite.

When running on gas oil as a charge after 350 hours of operation, the plant showed a yield of 68.58 percent of 400 end point gasoline; 17.92 percent of 8 gravity fuel oil; 9.9 percent of uncondensible gases and 3.6 percent of coke and plant loss.

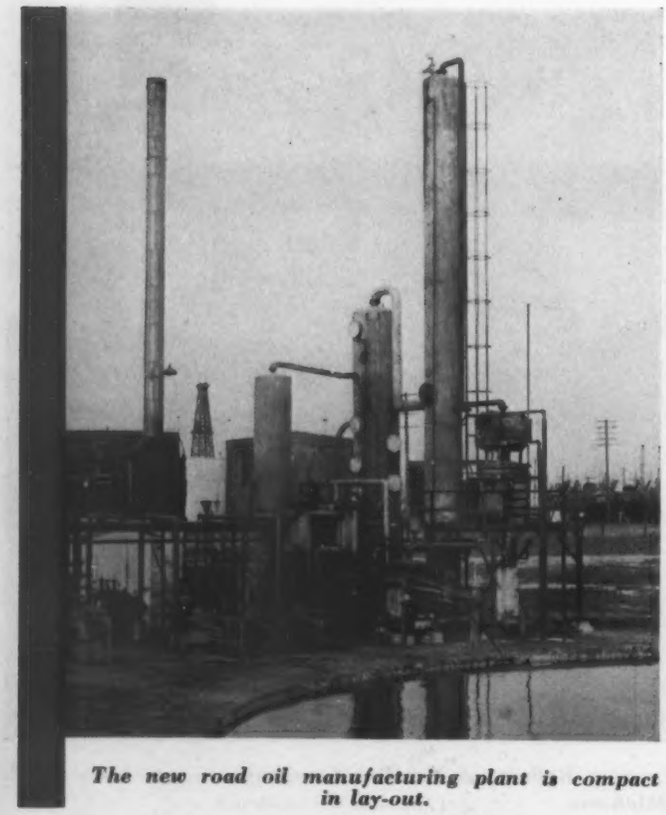


Double furnace Dubbs cracking plant, Cushing Refining & Gasoline Company, Cushing, Oklahoma.

Mohawk Refinery *Specializes in* Road Oils

MOHAWK Petroleum Company in the Fruitvale field near Bakersfield, can process about 6500 barrels of crude daily. Recently, because of the nearness of a supply of crude which has a desirable asphalt content, this company erected a new unit so that road oil and other heavy products could be manufactured. The crude processed through the original skimming plant is secured from the fields southeast of Bakersfield, particularly from one designated as the "Weed Patch". This oil has a gravity of approximately 26° A.P.I. and contains about 25 percent gasoline. The principal units used in both the old and the new plants are similar in design, consisting of heat exchangers, flash towers, vapor fractionators and pipe stills of Southwestern Engineering Corporation type.

The crude charged to the first unit is handled by reciprocating steam pumps located near the distillation units. It is picked up from the working storage tanks and passed to the residuum-to-charge tube and shell exchangers at a pressure of about 50 pounds. Comparatively low temperatures are applied to the oil in the first process, and it enters a primary flash column used to remove the lighter ends from the crude before it passes through the pipe still. Provisions are made to condense and cool this primary cut separately from other products but the stream is usually blended back with the other gasoline removed from the oil while in process. The temperature on the oil in the primary flash tower is usually low enough that the end point of the overhead product is disregarded, and the cut taken without refluxing the stream, other than the refluxing obtained from plate to plate as the vapors rise through the column.



The new road oil manufacturing plant is compact in lay-out.

After the oil passes through this column, it is again picked up by pump and passed to the pipe still at a temperature of about 250 to 275°F. Passing through the transfer line, the temperature is about 500°F., and the oil is again flashed in a vapor tower to remove all of the more volatile fractions remaining in the oil. Two cuts are removed from this unit; the bottoms being fuel oil, and the overhead being a composite mixture of gasoline and other heavier fractions. These lighter fractions are fractionated to a top temperature of about 400°F. with a stove oil cut. Fuel oil is removed from the base of the vapor tower and passed through the incoming crude exchangers so that the initial temperature is applied to the oil in first skimming operation.

The composite vapor stream from the flash column or vapor tower is led, after refluxing, to the fractionator column where two cuts are removed. The overhead steam is composed of the regular gasoline grade having an end point of about 418°F. The bottom cut is composed of the stove oil, Deisel oil for engine fuel (which is used in large quantities on the Pacific Coast) or furnace oil depending upon the market requirements. This column is refluxed to a top temperature of approximately 275°F. by pumping condensed gasoline back over it so that the

end point of the gasoline is constant. Adequate liquid level controls are used in the plant as well as automatic temperature and flow controllers.

The second unit was completed in the latter part of 1934, and was designed as to layout by the company engineers. Some of the units used were fabricated especially for this plant, while others had formerly been in service in other plants. As road oil is the principal product to be recovered in this unit, especial attention was given to the ground plan and the flow of oil through the units. It was designed to be flexible enough that any grade of road oil may be manufactured, but ordinary skimming operations may be carried out as well. If used as an ordinary topping plant, gasoline may be recovered as an overhead stream, while fuel oil would be removed from the base of the flash column.

Pumping equipment for handling road oils at the new unit.

Crude produced from wells in the Fruitvale field is unusually adaptable to the manufacture of road oil and other heavy asphaltic products. The small amount of gasoline contained in this crude, about 8 to 10 percent, has an octane rating of about 72.

The ground area required for the construction of this plant was quite small, not because of the scarcity of land as is sometimes the case in other locations in Southern California, but because of the desire of company engineers to place the various parts of the plant as close together as possible. It was located near enough to the older skimming plant so that the one stillman can operate both plants. The new plant has adequate centrally located control instruments, and when it is in service, it is not necessary for the operator to be constantly on the move from one control station to another.

Like other plants of this nature, the flexibility is such that a variety of road oils may be manufactured, and when so doing, the temperatures and pressures vary, as well as the steam consumption. California road oil specifications are such that this product may be manufactured having various penetrations, running from 50/60 to 80/90, each of which require a different set of plant temperatures and conditions.

The general operation of the road oil reduction unit is similar to the skimming plant, in that heat exchangers are used and the charge of crude is first flashed into a primary column before it is pumped to the pipe still. Some of the gasoline is removed in this operation, and the subsequent columns are used as stripping and reducing units when the topped crude is processed to products other than fuel oil. Some gasoline naturally remains in the crude after it passes through the primary flash column, and it is removed in the vapor fractionator after the charge has been pumped through the secondary flash column.

Steam is used in reducing the charge to the desired grade of road oil, and the fractions recovered through the vapor fractionator varies. If a more fluid road oil is manufactured, less of the gas oil is driven from the charge than if the product is reduced to a heavier grade. The top of the vapor fractionator is maintained at a temperature sufficiently low that the quality of the gasoline removed as an overhead stream may be comparable to the regular grade of fuel sold in California. The combined stream from the primary flash tower and that removed finally from the crude is condensed in tube and shell units and run to storage as a single product.

Steam is used in the stripping and processing column to assist in reducing the residuum, or road oil to the proper quality, and tests are conducted regularly in the plant laboratory to determine this condition.

Gasoline manufactured from California crude oil is generally off color when it comes over with the stream from the distillation unit, which makes it necessary to treat it with some process. Usually sulfuric acid is employed for this purpose, requiring a number of vertical treating columns to separate the sludge and neutralize the gasoline.

The capacity of both of these plants is about 6500 barrels of fresh crude charge daily, the older one having the larger throughput. Oil processed is governed by allocations when manufacturing gasoline and motor fuel, but the processing of heavy crude for road oils is governed by the market conditions for that product.

Elwood Plant Has Interesting Safety Features

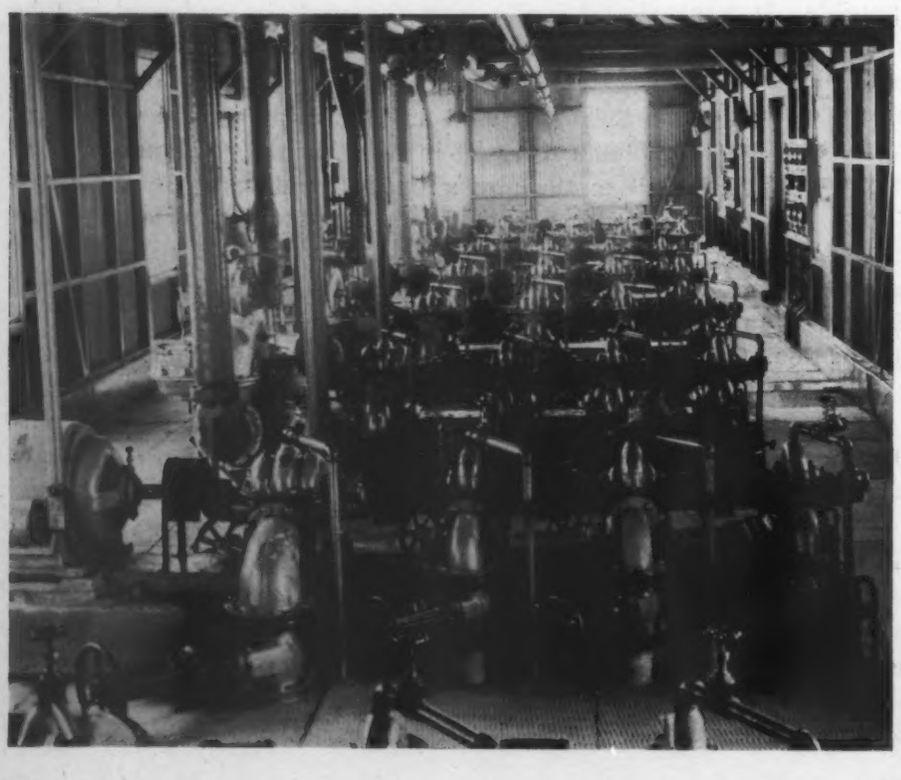
BARNSDALL Oil Company-Rio Grande Oil Company, joint owners of a considerable portion of the Elwood field, near Goleta, California, built a gasoline plant when the field was new which has made as much as 65,000 gallons of natural daily. A large investment in equipment was necessary to process the casinghead gas, and to produce the wells by gas lift. Two engine rooms were built, one to handle the gas from the wells and the other to return the dry gas to the wells.

Four distillation units also were built, all served by centrifugal pumps to handle the lean and rich oil together with the necessary amount of water for cooling purposes and to reflux the stills and stabilizers. Eight separate units of centrifugal pumps were set in one building, four of which were active, and the other four were standby. Steam is used to drive the pumps through direct turbine drive, while the standby units are connected to electric motors. The boilers are fired with natural gas taken from the dry gas line.

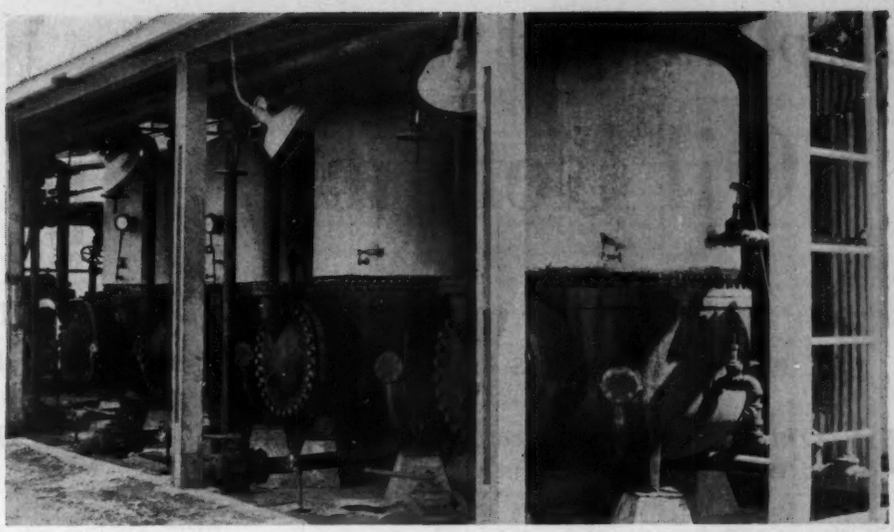
The operation of this plant is carried on in about the same manner that most gasoline plants are run, but several safety devices were installed which differ from those ordinarily used. The boiler room has been equipped with a common shut-off fuel line with a control placed some distance away, to be used when it is necessary to shut off the fuel supply in case of fire. This control is equipped with a lubricated plug valve which requires only a quarter turn to either open or close it. It is equipped with a long handle, standing out to make it convenient to operate.

In addition to this safety feature, the boiler fire boxes are equipped with steam smothering lines. A water line from the plant pressure system leads to the boilers, with a control plug valve similar to the fuel control, placed nearby, also fitted with a long handle, or plug wrench, which the operator may open or close "on the run." The water line was laid in the fuel line conduit in front of the boilers, with an individual lateral leading through the brick fronts to the combustion chamber.

If a fire should occur in the plant making it necessary to snuff the fires in the boiler room, the operator would immediately close off the fuel line by swinging the long plug wrench handle, and open the water line leading to the fire boxes. The source of fuel would be immediately cut from the burners, and the water spray entering the combustion chambers would flash to steam when coming into contact with the heated setting. This sudden rush of water not only cools the surface below the ignition point, but forms a smothering blanket of steam which pours out of the front of the boilers and fills the stacks and



Battery of centrifugal pumps in Barnsdall Oil Company's gasoline plant at Elwood, California. Steam smothering line suspended above pumps.



Four seawater evaporators used by Barnsdall Oil Company at Elwood, California, to provide boiler water.

tubes preventing propagation of flame from gas or gasoline.

Another preventive, and protective measure was installed in the main oil pump room. Packing sometimes blows from stuffing boxes and provides a source of hazard, especially if the defective, or worn unit is handling light material, such as gasoline for refluxing the columns and stabilizers. A steam header hangs from the beams of the building and extends its entire length over the pump battery. The line is made of three-inch pipe with spray nozzles "looking down." These nozzles were made in the plant from half-inch pipe nipples each having its extended end closed to a small opening by welding.

The control to this header is outside the room and consists of a lubricated plug cock similar to the ones used in the boiler room control apparatus. The three-inch line leads directly from the boiler room and is full of steam at all times at operating pressure. To operate this safety device, the operator runs by the control valve opening it with a quick swinging motion and the pump room is immediately filled with a smothering cloud of live steam.

Steam control line at end of pump room used to flood room with steam in case of fire.

CURTAILED OPERATION

Since the plant has been curtailed in production, through declining gas volume and proration, it has been difficult to manufacture a satisfactory product having the desired vapor pressure, and yet containing no propane. The capacity of the stabilizer is sufficient for a considerably larger volume of raw gasoline, when operated continuously. At present the column is operated intermittently. This procedure works satisfactorily when the column is in service, but when the stored gasoline has all been processed and the column taken from service, the light gasoline held by the top trays has a tendency to flow downward and fill the lower part of the tower. When it is placed in service again, the light gasoline, containing the separated propane is immediately drawn from the tower with the fractionated product, causing the finished gasoline to contain an appreciable amount of undesirable constituents.

To overcome this difficulty, an extra liquid level control valve was placed on the column which permits a portion of the stable product to flow back to the stock tanks to be recycled. By doing this, the volume is sufficient that the stabilizer may be operated through a more extended period with efficient fractionation. No more loss of gasoline has appeared when operating in this manner than occurred when operating the column with a full load when the gasoline production was larger.

Because of the proximity to the ocean, corrosion from salt spray has been excessive. Various protective measures have been tried which were recommended to prevent rusting of metals, even to a spray coat of heavy resinous petroleum by-product, but the penetration of salt water continues.

The scarcity of a supply of fresh water has made it necessary to evaporate sea water for boiler use, and a battery of enclosed units were installed when the plant was built. Considerable exhaust steam is available, because of the number of turbines operated, and this exhaust is used in the evaporators to reduce the sea water so it can be used in the boilers. These evaporators are similar in design and operation to those used in ocean vessels. The condensate from the exhaust is saved to supply a part of the boiler make-up water, and the make-up not supplied in this manner is augmented by evaporated water passed through the water conditioners.

Inspection of
Oil Refinery Equipment

PART 4

RECORDS AND FORMS REQUIRED

FRANKLIN L. NEWCOMB

Supervising Engineer, Safety Inspection Division, General Engineering Department, Standard Oil Development Company

RECORDS, and forms for records, may be divided into two general classes, namely:

(a) Field data records and forms,
(b) Office records and forms.

All data taken and recorded in the field should, of course, become a part of the office records. On the other hand, after receipt of the field data, it becomes necessary to compare it with data previously taken. Certain records and forms strictly for office use are necessary to expedite such comparison and aid in reaching sound conclusions. Also, other forms may be necessary for following up recommendations to see that they are done.

In preparing forms for recording field data, it is necessary to bear in mind several things. The form should be as simple as possible. It should clearly indicate all of the data required so that the inspector will not omit anything required by the office for comparison or computation. It should be arranged so as to expedite the work of the inspector as much as possible. All forms for field work should be of one standard size, preferably 8½ by 11 inches. It is usually advisable to have one form for recording thickness of parts and other forms for recording construction details obtained in the field.

PRESSURE VESSEL FORMS

Figure 11 illustrates a form found convenient for recording construction data of a riveted pressure vessel. The sketch is completed by drawing lines to indicate all of the seams and by filling in one of the dotted lines to show whether the bottom head is dished in or out. In addition, each attachment is indicated on the sketch by a cross or circle and given a key letter or number. A sketch of each joint is made under the proper heading at the right. All data called for by the form is filled in by the inspector from measurements made in the field. When completed this form will contain

S.I.D. 8 - 10A — Unit No:
Refinery: — Date:
DRUM: — Serial Number:
Size: — Safety Valve Setting:
Fabricated by: — Factor of Safety:
Dwg. No.: — Maximum Allowable Pressure:
Date Installed: — Tensile Strength:

	Heads	Shell
Original Thickness:		
Type of Head:		
Radius of Curvature:	Top Head	Bottom Head
Knuckle Radius:	Top Head	Bottom Head

Sketch all seams and attachments.

HEAD SEAM
Joint: (single or double rivet.)
Rivet Head Size & Type
Rivet Size
Rivet Pitch — L.F. — B.F.
Calculated Efficiency
Sketch

GIRTH SEAM
Joint: (single or double riveted.)
Rivet Head Size & Type
Rivet Size
Rivet Pitch — L.F. — B.F.
Calculated Efficiency:
Sketch

LONGITUDINAL JOINT
Type of Joint: (Lap or Butt)
Number of Rivet Rows
Size of Inside Butt Strap
Size of Outside Butt Strap
Rivet Pitch — L.F. — B.F.
Rivet Head Size and Type
Rivet Size
Calculated Efficiency
Sketch

List Attachments - Detail Data on Appended Sheet

Mark	Size	Type	Eff.

Allowable pressure - shell
" " - heads

INSPECTOR: FIG. 1.

FIGURE 11

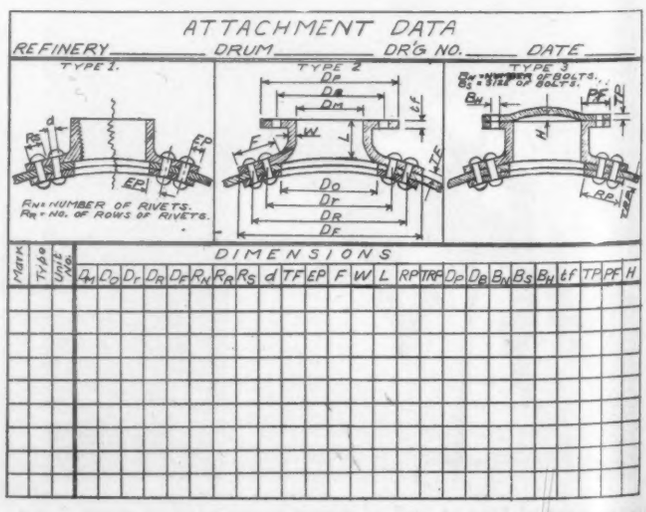


FIGURE 12

CONCURRENT with publication of Part 3 of this series of five articles by Mr. Newcomb notification was given that the entire series would be reprinted in book form upon completion of the series in the September issue. Following that notice a number of companies and individuals have requested copies. It is suggested here again that those wishing copies of this important work place their orders early so that delivery may be assured. The series will be completed in the September issue of THE REFINER and a limited number of reprints will be available shortly thereafter at a price of $1.00 per copy.

all necessary data for computing joint efficiencies and the allowable working pressure of the vessel, exclusive of attachments.

Figure 12 illustrates the form complementary to Figure 11 on which attachment data is recorded. At the top are illustrated various types of riveted attachments which may be encountered. The data required for each type of attachment is indicated by dimension lines and key letters. The key letters are, as far as possible, the initials of a description of the dimension required. To illustrate, "Do" is the *diameter* of the *opening,* "Dr" is the *diameter* of the *smaller* (inner) *rivet* circle, "D_R" is the *diameter* of the *larger* (outer) *rivet* circle and "D_F" is the *diameter* of the *flange.* When this form is completed by filling in all data pertaining to each attachment, it will be found that all necessary data for computing the replacement value of the attachment is available.

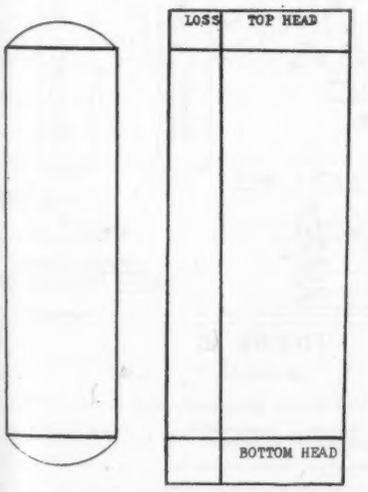
Forms for riveted vessels were chosen for the above illustrations since more data is required for computation of riveted vessels and attachments than is required for computation of welded vessels. Simi-

S.I.D. 8 - 10

DRUM _____ SIZE _____

DWG. NO. _____ FABRICATED BY _____

SAFETY VALVE SETTING _____ DATE OF FIRST RUN _____



ORIGINAL SHELL _____

ORIGINAL HEAD _____

LIMIT OF SHELL FOR ABOVE S.V. _____

LIMIT OF HEADS FOR ABOVE S.V. _____

CONDITION OF INTERIOR EQUIPMENT. DETAILS.

Remarks:

Refinery _____ Date _____ Unit No. ____

Inspector _____ Type of Unit _____

FIGURE 13

M-170 DRUM INSPECTION DATA

Serial No. _____

Drum _____ Unit No. _____ Size _____

Insp. Date															
Head															
Sheet No.															
Sheet No.															
Sheet No.															
Sheet No.															
Sheet No.															
Sheet No.															
Head															
S.V. Set.															
Allow. SV Set.															
Insp. By															

FIGURE 14

TUBE AND HEADER INSPECTION

REFINERY: DATE: TUBE MAT'L: SIZE: O. D. WALL THICKNESS

MAX. I. D. LIMIT= @ 60. V. SETTING

ROW NO.	TUBE NO.	HDR. BOX	TUBE END	ROLL	END				AV.	END			ROLL	TUBE END	HDR. BOX	REMARKS

FIG. 15

FIGURE 15

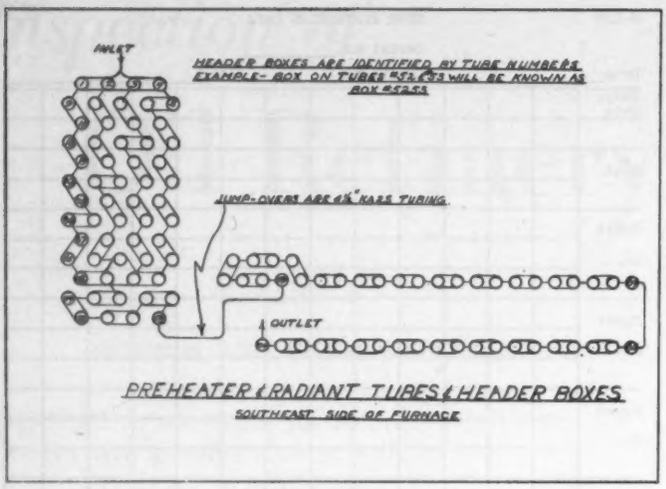

INLET
HEADER BOXES ARE IDENTIFIED BY TUBE NUMBERS.
EXAMPLE- BOX ON TUBES #51 & #53 WILL BE KNOWN AS BOX #51&53
JUMP-OVERS ARE 4½" HAIR TUBING
OUTLET
PREHEATER & RADIANT TUBES & HEADER BOXES
SOUTHEAST SIDE OF FURNACE

FIGURE 16

TUBE, HEADER BOX & PLUG REMOVALS

M-36

Unit No._____ Date:_____

Coil:_____

TUBES			HEADER BOXES			PLUGS		
No.	Material	A/c	No.	Material	A/c	No.	Material	A/c

REMARKS:-_____

Inspector:_____

B= Boiler Maker, E= End Corrosion, L= Limit, O= Bulge, R= Roll, S= Sag, T= Threads, U= Undersize, X= Header Box Oversize in Roll

Note:- On high pressure units, state type header box.

FIGURE 17

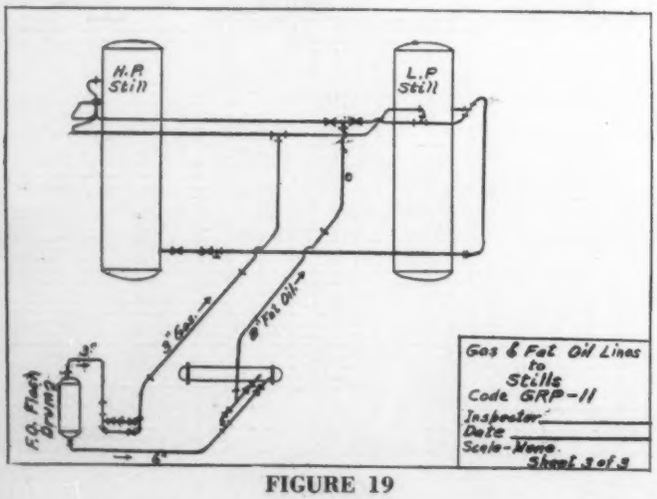


FIGURE 19

S.I.D.51

FURNACE AND TUBES UNIT # _____

DATE UNIT CAME DOWN FOR INSPECTION _____

DATE UNIT RESUMED OPERATION _____

WERE ALL TUBES MEASURED FROM BOTH ENDS WITH INSIDE MICROMETER?

WERE ALL TUBES WITHIN REACH MEASURED FOR OVERSIZE WITH OUTSIDE CALIPERS? _____ WHAT LIMIT WAS USED? RAD.___PRE.___REB.___

DRAW SHAPE OF ANY BULGE FOUND _____

DID YOU INSPECT THE ROLL AND FLARE IN THE HEADER BOX AND WHAT RESULTS? _____

WERE ANY TUBES SERIOUSLY SAGGED OR BENT? _____ DID YOU OBSERVE ANY CRACKED TUBES?____ DESCRIBE LOCATION OF CRACK IN TUBE AND LOCATION OF TUBE _____

DID YOU INSPECT ALL PLUGS?_____WERE ANY CONDEMNED?_____WHAT LIMIT WAS USED?_____ DID YOU INSPECT ALL HEADER BOXES?__

HOW MANY WERE CONDEMNED?_____ WHY? _____

WHAT LIMIT WAS USED?_____CONDITION OF CONCRETE_____

DOES THE BRICK WORK REQUIRE REPAIRS?_____DESCRIBE_____

CONDITION OF TUBE SUPPORTS _____

DID YOU OBSERVE ANY UNSAFE CONDITIONS DURING THIS INSPECTION?

INSPECTOR_____DATE_____REFINERY_____

FIGURE 18

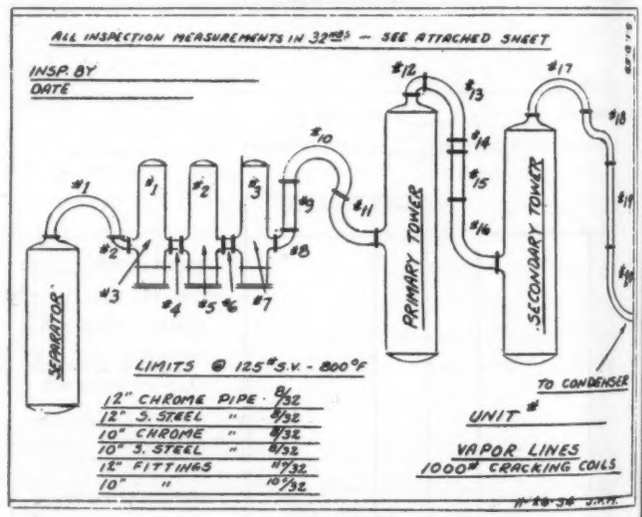


FIGURE 20

Refinery: LINE INSPECTION Date S.I.D. #1
Line & Location: (include sketch)

Pressure, Normal: Maximum: How protected against excess pressure?
Date Installed:

Pipe: Size	Material	Class	Type of Joint	Overhead Type Support	Underground Depth Buried	Location From	To

Valves & Fittings: Size	Material	Class	Screwed or Flanged	Condition

Condition of Line: (Show measurements on separate sketch)

Corrosion Inside	Outside	Eccentric Thickness	Deposits	Protection at Roadways, R.R., etc.

Repairs made:

Test Pressure: Pressure Drop in Minutes State whether line was blanked or valved off during test:
Has there any leakage at blanks or valves during test? Leaks Found

Comments: (Use separate sheet if necessary)

FIGURE 22

lar forms can easily be worked up for welded vessels.

Figure 13 illustrates a form for recording thickness measurements taken on a vessel. All seams or joints are indicated by lines drawn on the sketch at the left. Also, on this sketch, the approximate location of each thickness measurement is indicated, using different marks to differentiate between the measurements taken on the far side and those taken on the near side of the vessel. The thickness obtained is recorded in the rectangle directly in line with the mark indicating the location at which the measurement was taken. If the thickness recorded at the previous inspection is available, the inspector records the loss in thickness in the column headed "loss". The inspector also fills in all other data called for on the form. This includes the minimum allowable thickness of both the shell and heads for the safety valve setting. He obtains this either by computation or from tables of limits if he has such a table applicable to the vessel. These limits are, of course, checked in the office upon receipt of the report to be sure the vessel is good for the safety valve setting.

Where a large number of vessels of one design are in use, it may expedite the inspection to have a special form covering such vessel. This form would contain a sketch of the vessel showing the number of sheets, location of attachments and giving the original thickness of the various parts.

Figure 14 illustrates a convenient form for a continuous record of an individual vessel. The field data is transcribed onto this form after each inspection and the progress of corrosion can be readily obtained over any period. Appendix "D" of the A. P. I.—A. S. M. E. code for unfired pressure vessels also shows a form for a similar purpose but also includes a record of transfer of ownership and location and certain other data.

Variations of the above two forms will undoubtedly suggest themselves to those requiring information of this character. Where a group of vessels compose an operating unit, it may be desirable to keep a record of the minimum thickness of the shell and head of each vessel on one form so that the rate of corrosion on the different vessels can be quickly and readily compared.

TUBE AND HEADER BOX FORMS

For recording measurements of tubes and condition of tube header boxes, a form similar to Figure 15 is convenient. Where there are several different types of furnaces in use, or where the numbering system of the tubes varies from one plant to another, a sketch of the tube and header box arrangement, similar to Figure 16, should be used to facilitate location of any particular tube or header box and

S.I.D. 58

MEASUREMENTS OF VAPOR LINE – UNIT # 1000# C. COILS

INSPECTION DATE		INSPECTION DATE	
#1 BEND MAT. DATE INST.		#13 BEND MAT. DATE INST.	
#2 ELL MAT. DATE INST.		#14 SPOOL MAT. DATE INST.	
#3 SPOOL MAT. DATE INST.		#15 SPOOL MAT. DATE INST.	
#4 SPOOL MAT. DATE INST.		#16 BEND MAT. DATE INST.	
#5 SPOOL MAT. DATE INST.		#17 BEND MAT. DATE INST.	
#6 SPOOL MAT. DATE INST.		#18 BEND MAT. DATE INST.	
#7 SPOOL MAT. DATE INST.		#19 SPOOL MAT. DATE INST.	
#8 ELL MAT. DATE INST.		#20 BEND MAT. DATE INST.	
#9 SPOOL MAT. DATE INST.			
#10 BEND MAT. DATE INST.			
#11 BEND MAT. DATE INST.			
#12 ELL MAT. DATE INST.			

FIGURE 21

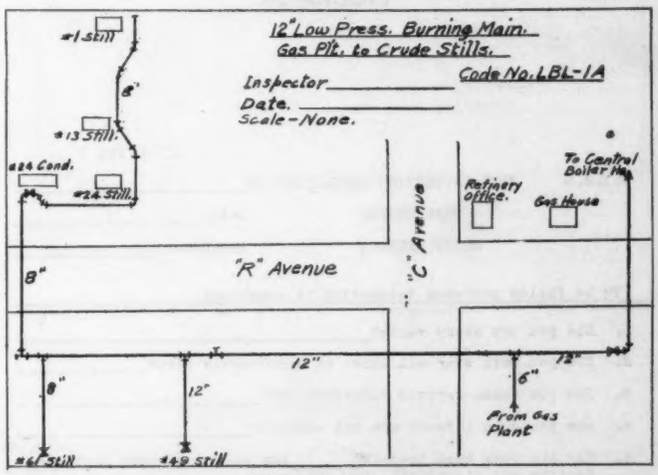


FIGURE 23

F.I.D.1 S.I.D.100

FIRE PROTECTION FACILITIES AT _____
FOAM SYSTEM
SLIPPAGE TESTS AND REPAIRS ON PUMPS DATE _____

Name of Inspector

Maker's Name	Maker's No.	Plant No. of Pump	Size of Pump	Rated cap. in G.P.M. each sol.	Rated Strokes per minute	Slip in strokes per min. Acid	% Slip Acid	Slip in strokes per min. Basic	% Slip Basic	Sol. press. used in slippage test	Remarks

Did you find all oil cups filled?
Did you find all lubricators filled?
Was there an extra supply of oil in the house?
Were the pumps ready for instantaneous us
At what pressure did relief valve release?
At what pressure is relief valve now set?
Defects found, repairs made, and additional remarks.

FIGURE 24

F.I.S. 5

FIRE PROTECTION FACILITIES AT _____
FOAM SYSTEM Date _____
FOAM PUMP HOUSES Inspector _____

Foam Pump House No.	Location	Is it fire-proof	Kind of Sash	Kind of Glass in Sash	Are All Doors Fireproof	Are there any Oil Pumps in same rooms	Is it Seriously Exposed to Fire	Are all Valves Easily Accessible	Is it kept in a neat and orderly condition	Is it Kept Locked	Is a key easily available

Remarks and recommendations for improving conditions:

Quantities of Chemicals:	Required for 100% Recharge	On Hand	Amount Short
Andrex			
Foamite			
Alum. Sulphate			
Bicarbonate of Soda			

FIGURE 25

F.I.S.

S.I.D. 100

FIRE PROTECTION FACILITIES AT _____
FOAM SYSTEM Date _____
FOAMING QUALITIES OF SOLUTIONS Name of Inspector _____

Tank No.	Amt. co. sol. used in c.c.	Volumes obtained in c.c. Initial	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									
A									

Remarks:

FIGURE 26

S.I.D.100

F.I.S.8 FIRE PROTECTION FACILITIES AT _____
FOAM SYSTEM Date _____
MISCELLANEOUS Inspector: _____

(To be filled out when inspection is complete)

1. Did you try every valve? _____
2. Did you walk over all lines on hydrostatic test? _____
3. Did you check layouts furnished you? _____
4. Are you sure layouts are now correct? _____
5. Was all foam hose tested? _____ How many feet were found defective and discarded? _____
6. Was system kept in an orderly manner? _____ If not, explain. _____
7. Were any obstructions found around valves, hydrants, or hose cart houses? _____ If so, explain. _____
8. Are all valves and hydrants easily available in case of fire? _____
9. Do you feel that system is adequate to handle any fire which might start and prevent it from becoming serious? _____
10. What is the status of all recommendations not completed at last inspection? _____

FIGURE 27

CRACKING COIL INSPECTION

REFINERY _____ DATE _____ UNIT NO. _____
INCLUSIVE DATES OF INSPECTION _____ TO _____ ELAPSED TIME _____ HRS.
INSPECTION STARTED _____ SUSPENDED _____
" " _____ " _____
" " _____ " _____
" " _____ FINISHED _____
PRESSURE TEST STARTED _____ COMPLETED _____

TYPE OF UNIT:	O.K.'D WITH SAFETY VALVES SET AT:	LBS. PER SQ. IN.	TEST PRESSURE	TEST MEDIUM
	PUMP			
RUN NO.	COIL INLET			
HRS. RUN:	SOAKING DRUMS			
HRS. PER RUN	BUBBLE TOWER			
ORIGINAL FIRING DATE:	ACCUMULATOR			
	SEPARATOR			

THE FOLLOWING REPAIRS OR RENEWALS HAVE BEEN MADE AT THE TIME OF THIS INSPECTION BY ORDER OF THE REFINERY MANAGEMENT:

THE FOLLOWING REPAIRS OR RENEWALS HAVE BEEN OR ARE TO BE MADE BEFORE THE UNIT IS FIRED AS A RESULT OF THIS INSPECTION:

THE FOLLOWING REPAIRS OR RENEWALS SHOULD BE MADE AS SOON AS POSSIBLE BUT NOT LATER THAN THE SPECIFIED DATES:

INSPECTORS:

FIGURE 28

CRACKING COIL INSPECTION

UNIT NO. _____

REFINERY: DATE:

GENERAL REPORT ON UNIT

GENERAL CONDITION OF PUMP AND RECEIVING HOUSE:

HOT PUMPS

MAKE TYPE SIZE

STEAM PRESS.: THRU-PUT: TEMP.:
TYPE OF AUTOMATIC PRESSURE REGULATOR: SERVICE:

GENERAL CONDITION OF COIL AND SETTING
BRICKWORK:

PLUGS

TUBES

SOAKING DRUMS:

FRACTIONATING EQUIPMENT:

PRESSURE TEST

INSPECTORS:

FIGURE 29

to avoid any possibility of misunderstanding between the office and field forces.

For reporting replacement of tubes, header boxes and plugs or return bends and the reason for such renewals, a form similar to Figure 17 will be found useful.

In order to guide the inspector in the work he is to do and to assure that he has made a complete inspection of tubes, header boxes, plugs and other parts of the furnace a form similar to Figure 18 is often found advisable.

PIPING, VALVE AND FITTING FORMS

The piping work around refinery equipment is so varied that to make a form, or forms, generally applicable is almost an impossibility. Single line isometric or near isometric sketches showing all valves, fittings, bends and joints, have been found quite satisfactory for this purpose. Figure 19, illustrates the type of sketches used. It should be noted that, while they are crudely drawn by the inspector, they give a clear picture of the piping. In using these sketches, the inspector indicates the location of each measurement taken and notes the measurement on the print. These sketches are in pencil, on 8½ inch by 11 inch vellum, which can be obtained in pad form. A sheet of isometric paper under the vellum assists in making the sketch.

In some cases, a more elaborate sketch with key numbering and an accompanying form for recording the data may be desirable. An example of such a form is illustrated by Figures 20 and 21, which are complementary to each other.

For recording data in connection with long yard lines a form similar to Figure 22 is useful. This form supplies a condensed description of the line and the conditions found. It calls for a sketch of the line. This sketch need not be to scale but should indicate all principle land marks and "tie-in" points. A typical sketch accompanying such a form is shown in Figure 23. To expedite identification of lines, a system of code letters and numbers has been found useful. As an example the line illustrated is known as code "LBL-1A". All low pressure burning lines are given an "LBL" number, process gas lines a "PGL" number, etc. A chart is then made listing all code numbers and the points between which each line connects. As the inspector finishes an inspection of any line, a date is filled in opposite the proper code number and thus one knows at a glance which lines have been inspected and which remain to be done. There should be a separate sketch and separate report form filled in for each code number.

INSTRUMENT AND GAUGE FORMS

Safety Valve Forms. Forms for these two purposes are so simple that illustrations are not required. Gauge forms should show the make and range of the instrument, where located on the equipment,

Inspection of High & Low Pressure Equipment

Unit No._____ Run No._____ Date_____

The following equipment must be OK'd before unit is placed in operation. Rules for the inspection of equipment and safety standards are to govern

Item No.	Description	OK'd by	Time
1	Piping - Fittings - Valves		
2	Tubes - Header Boxes - Plugs		
3	Soaking Drums		
4	Safety Valves & Gauges		
5	Thermometer Well		
6	Internal piping in drums and towers		
7	Still bottoms		
8	Brickwork		
9	Steam Test on Drums		
10	Oil Test on Coil		

REMARKS:

Inspector:_____

FIGURE 30

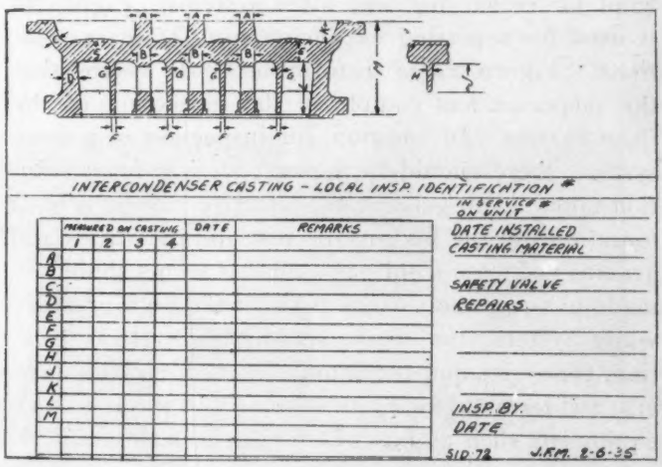


FIGURE 31

Sheet __ of __

INSPECTION DIVISION

RECOMMENDATIONS AND HOW COMPLIED WITH

ORIGIN_____ UNIT_____

LETTER OF_____ EQUIPMENT_____

RECOMMENDATION	DATE APPROVED	WILL BE COMPLIED WITH AS FOLLOWS	WORK STARTED	WORK COMPLETE	REMARKS

FIGURE 32

the amount it was high or low and the fact that it was correct when returned to service. Other instrument forms should show similar data applicable to the type of instrument. Safety valve forms should show the make, type and size of valve, its location on the equipment, the pressure at which it was originally set, the spring number, the pressure at which it popped both the first and second time and the pressure at which it was reset when put back into service.

Fire Protection Facility Forms. Since the fire protection facilities in a modern refinery are extensive and consist of many different component parts, it is particularly important that the forms for reporting the inspection indicate clearly all of the information required. Four typical forms, Figures 24, 25, 26 and 27, are illustrated. Figure 24 covers inspection of pumps and includes a condensed description, slip test data and several questions to assure that all necessary supplies are available for operation and that accessories are in good condition. Figure 25 is a form used for checking pump houses and reporting quantities of chemicals on hand for recharging wet foam systems. Figure 26 is used for reporting expansion tests of foam solutions. Figure 27 is a form used to assure that the inspector has completed the inspection of the foam system. In addition, for inspection of a foam system, there should be forms covering foam solution tanks, foam generators, defective valves, defects found during the hydrostatic test and quantities and gravities of foam solutions. Similar forms should be made to cover the various parts of the high pressure water system; the steam smothering system; location, type, size and condition of portable extinguishers; and forms to facilitate inventory of the accessory equipment such as hose, hose reels, nozzles, miscellaneous tools, fire blankets, portable foam columns, protective clothing and so forth.

MISCELLANEOUS FORMS

At times, it is desirable to have a condensed report of the inspection forwarded immediately upon completion of the inspection and before the data taken in the field can be completely transcribed. A special set of forms for such a report is illustrated by the "Cracking Coil Inspection" forms illustrated in Figures 28 and 29 and another is illustrated by the "Inspection of High and Low Pressure Equipment" form illustrated in Figure 30. At times, it is necessary to get special information to compute the strength of a complicated part or piece of equipment and a special form will assure that the inspector obtains the required data. Figure 31 calling for specific measurements on an intercondenser casting illustrates such a form. Figure 32 illustrates a form used for following up recommendations and covers the instructions of the management concerning the recommendation and shows when the work was started and completed.

The above is not intended to cover all of the forms and records required by an inspection department, but is intended to give an idea of the various kinds of forms which will be required for record purposes. Most of the forms illustrated have been in use for a number of years and found satisfactory for the inspection forces using them. Some of them may be found useful as illustrated, others may be used in starting a new inspection service and later modified as experience may dictate. However, it is felt that each inspection force will have to develop forms as new work comes up and that all forms will have to fit the particular organization and the demands made on the organization.

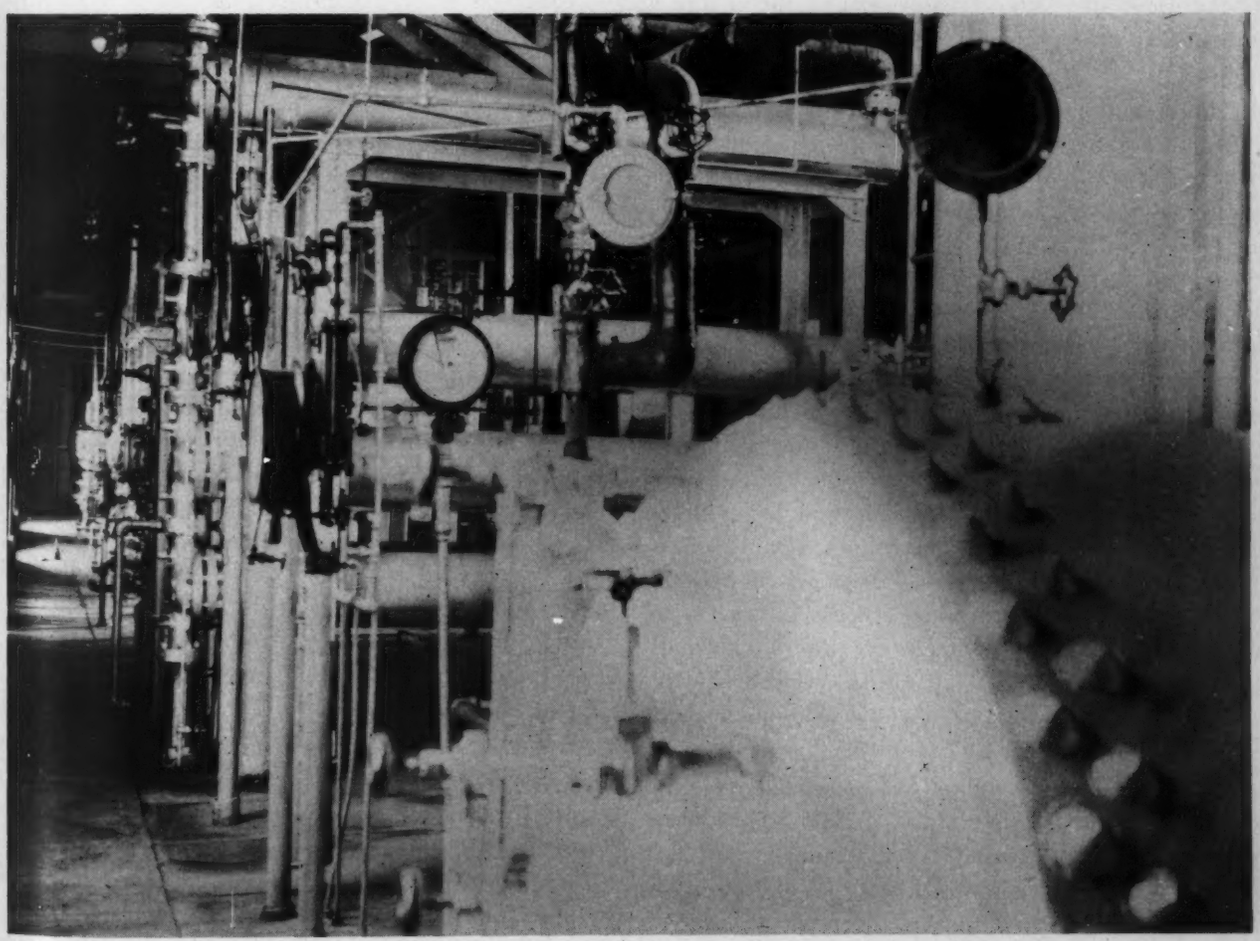
Motor Fuels

For Company's Fleet Produced at Natural Gasoline Plant

SKELLY Oil Company, with a large production of natural gasoline in the Panhandle of Texas has been making a grade of motor fuel from natural gasoline that is used by drivers of company automobiles and trucks in a very satisfactory manner. This company owns and operates a refinery equipped with a vapor recovery plant producing light gasoline that often prevents the sale of natural gasoline as manufactured in the field to the refinery for blending purposes. This situation prevents the field plants from disposing of some of their production, and when these field plants fractionate to motor fuel, prevents the refinery from selling motor fuel to them. This is a condition not unusual with larger companies operating both refineries and gasoline plants.

Not all of the manufacturers of natural gasoline have sufficient automotive equipment to justify the manufacture of quantities of motor fuel from their regular production, in which case they may be then forced to sell at a reduced price. Many of those who have sufficient outlet for gasoline which may be used in company cars and trucks are making arrangements by which natural gasoline can be fractionated down to a very satisfactory fuel for these motors.

Since the Panhandle district offices are located on the Shaffer ranch properties of Skelly Oil Company,



Interior of stabilizer system building housing column accessories and controls. Skelly Oil Company's Shaffer Ranch plant.

and since the Shaffer gasoline plant is equipped with fractionating columns which can produce any desired type of gasoline, all of the motor fuel necessary for the operation of the fleets of company trucks and passenger cars is manufactured there. High pressure apparatus as well as that designed to operate at low pressure is available, but when it is necessary to make up a supply of fuel to be used in the automobiles and trucks, one of the low pressure units is used.

When it is necessary that several thousand gallons of motor fuel be prepared a stabilizer is placed in service for that purpose. This column contains 29 trays and was designed to operate at 100 pounds gauge. In normal routine operation of the plant, this column is employed when it is desired to top the natural gasoline by removing the propane and butane through the overhead vapor line, and the low vapor pressure product from the base. This is done when there is sufficient demand for propane and butane, as well as a demand for a low vapor pressure product. The overhead cut is subsequently processed through another tower operating at much higher pressure for the actual separation of propane from butane. Some of the gasoline manufactured in the Panhandle does not contain sufficient butane to bring the propane-free natural gasoline up to a true 26/76, and it is necessary to add butane to the propane-free gasoline to bring about the desired results, therefore the use of the butane removed from the charge in the manufacture of motor fuel prevents a waste of that product.

In the operation of this low pressure column for the manufacture of motor fuel, the raw plant production is fed to the tower as it comes from the condensing coils. Two pumps are set in the pump room serving this column, size 10 x 6 x 12 inches. They deliver 1200 gallons per hour to the column against 100 pounds pressure. The hookup of this column is virtually the same as others of this type, having in the accessory list, three gasoline heat exchangers and one preheater. Raw plant production is pumped to the exchangers and through the preheater where the temperature of the gasoline in process is raised to 240° F. It enters the column either on the ninth or tenth tray, the selection being determined by the temperature of the column at the point of entry. If the ninth tray carries a temperature corresponding to the incoming charge, then that tray is selected; but if the column temperature differs materially, and the tenth tray has a temperature more nearly like that of the raw gasoline entering the column, then the gasoline is introduced at that point.

A standard kettle, or reboiler, is operated with this hookup, carried at a temperature of 300° F. by the introduction of boiler pressure steam through the tubes. By this application of additional heat in addition to that applied through the operation of the preheater, vapors not desired in the finished product are driven from the material in process and forced to ascend the column to meet the downward stream of gasoline as it enters the tower through the points provided and selected to meet the particular operation conditions encountered.

As the raw manufactured product of the gasoline plant utilized as a charge for this column in the manufacture of motor fuel has a vapor pressure of 44 pounds Reid, a large percentage of it is not fitted for use as motor fuel, and because of this a large volume of it must be removed from the tower through the overhead vapor line. The end point of the raw feed runs about 350° F. and the low initial point is due to the saturation of the product with propane and other light fractions picked up in the absorbers.

Following is a representative distillation of the raw feed normally fed to the column when manufacturing motor fuel:

92.0°	A. P. I. Gravity
Plus 30	Saybolt color
Sour	Corrosive
50°F.	Initial Boiling Point
100°F.	36% over
140°F.	62% over
212°F.	76% over
350°F.	82% over
350°F.	End point

After this product has been processed through the low pressure stabilizer column under the pressure and temperatures applied, the finished product has the following characteristics:

71.0°	A. P. I. Gravity
Plus 30	Saybolt color
Sour	Corrosive
Initial Boiling Point	114°F.
5% over at	128°F.
50% over at	156°F.
90% over at	226°F.
97.5% over at	376°F.
End point	376°F.
Vapor pressure, Reid	5 pounds

After the bottoms have been withdrawn, cooled in the heat exchangers by the incoming raw charge, shell units, this motor fuel is treated to remove the objectionable compounds by passing it through a continuous doctor treating plant. The overhead stream is all condensed and placed in storage for blending with subsequent production, or processed for the propane and butane contained in it. In most cases it is valuable in bringing up the vapor pressure of depropanized natural so that it can be classed as a true 26/70 gasoline. In either case, another column is utilized using higher pressures and closer fractionation than is necessary in the manufacture of motor fuel.

From the original charge of 1200 gallons per hour only 400 gallons of it is removed as a base product suitable for motor fuel having a five-pound Reid vapor pressure. This fuel has been used in company trucks and passenger cars in the Panhandle for a number of years with excellent results. During winter it provides a fuel having exceptional ease of starting, and with the high initial boiling point does not evaporate from the fuel tank readily.

115 TIMES A MINUTE

WE HAMMERED THIS HOSE AGAINST CONCRETE

. . . on the "concrete beater" Goodyear Style M Air Hose shows slow, even wear . . . no cuts or tears

—and proved it would outlast others under abusive service

PICTURE an air hose carrying full working pressure pounding and scraping across a rough concrete block over one hundred times a minute. No field service is half that rigorous!

But that's how Goodyear engineers set about developing a hose that would stand the rough usage encountered in mines, quarries and other heavy duty jobs.

One of the biggest difficulties was the cover—for when the cover scrapes through, the body weakens and soon you get a burst.

The "concrete beater"

To duplicate severest field conditions Goodyear engineers rigged up a machine they called the "concrete beater"—a motor-driven shaft through which air pressure could be applied, mounted over a concrete slab.

Then they coupled all makes of hose to this shaft—sent them thump, thump, thumping against the rough rock at full speed—115 times a minute—until the cover failed and internal pressure caused a burst. And at first Goodyear hose didn't last any longer than the others!

So the engineers started over—spent weeks in perfecting a new heavy duck body of special weave—a new and extremely heavy cover of high tensile, abrasion-resisting stock—and put it on the beater.

Hour after hour this new hose hammered against the concrete—*33 to 200% longer than other makes before the cover failed. And in total service it lasted 60 to 70% longer before bursting. Here, at last, was a hose that could "take it."*

That is how Goodyear Style M Air Hose was developed, and the records for long-lived, trouble-free, economical service it has piled up on the nation's hardest jobs proves it as superior as these first tests indicated.

Individually specified by GTM

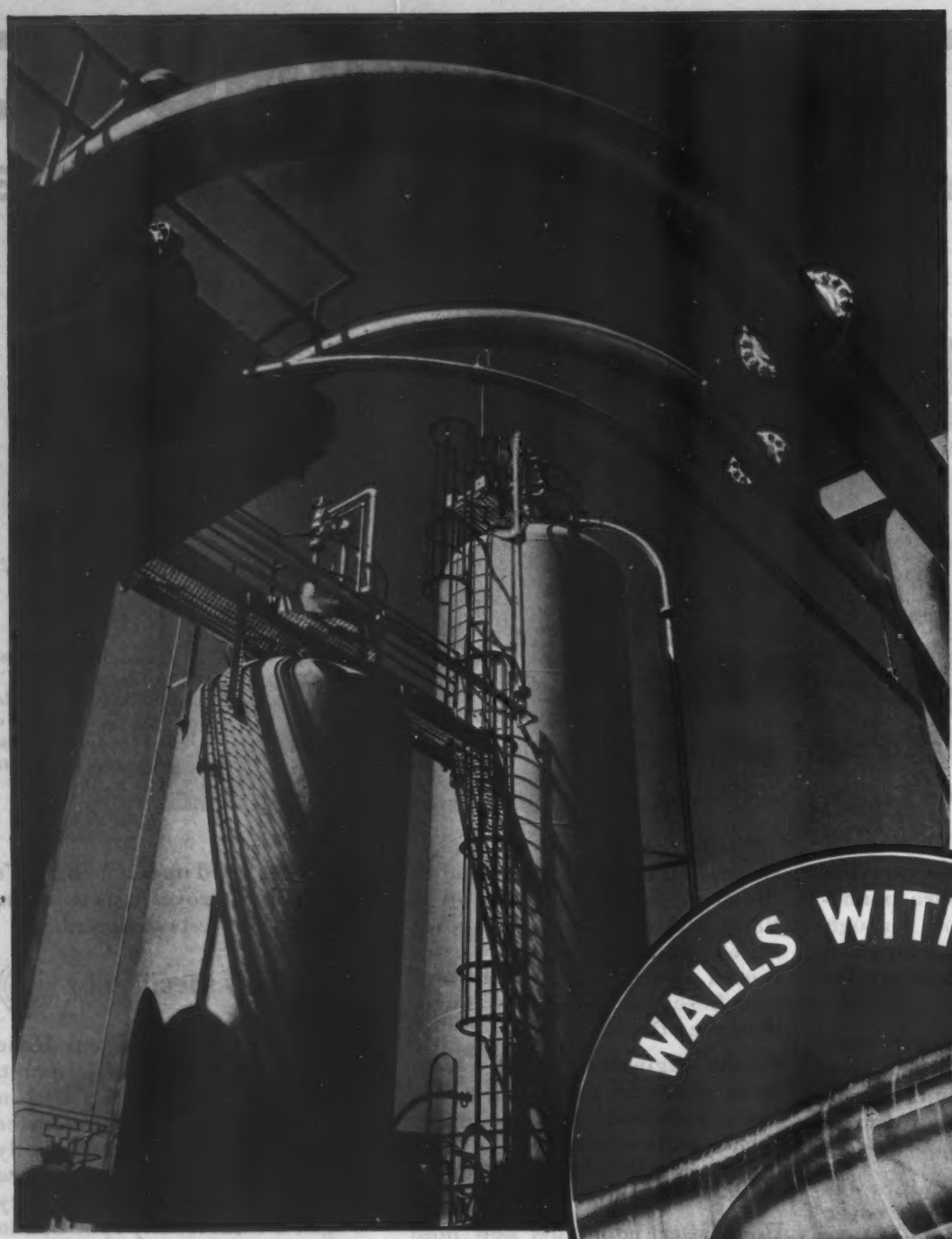
Whatever type Goodyear Hose you buy—air, steam, acid, oil, paint, water or gasoline—will give you the same outstanding service because it, likewise, is specially developed to meet actual service conditions, and because every length is individually specified to its particular job by the G. T. M.—Goodyear Technical Man.

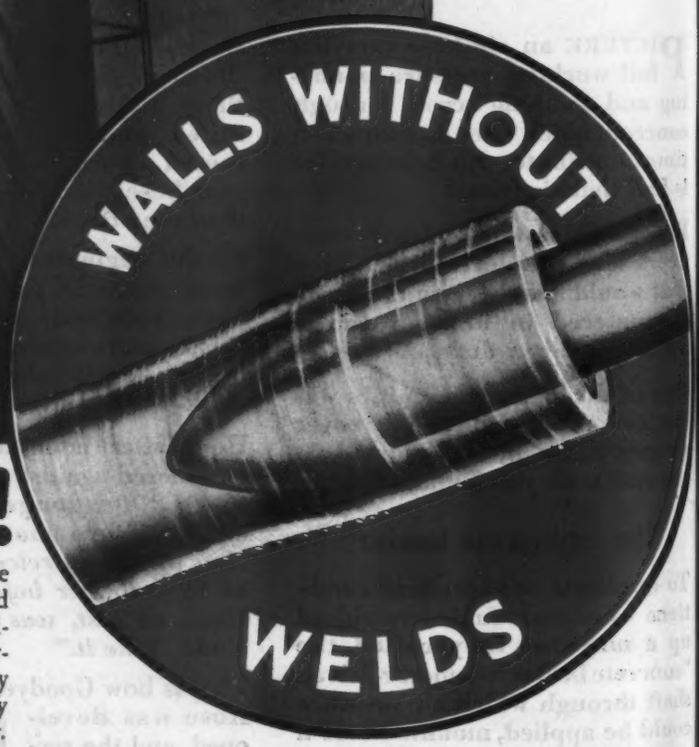
Many industries entrust all their hose problems to this qualified expert—perhaps he could cut your costs, too. A line to Goodyear, Akron, Ohio, or Los Angeles, Cal.—or the nearest Goodyear Mechanical Rubber Goods Distributor—will put his wide experience at your disposal.

BELTS · MOLDED GOODS
HOSE · PACKING
MADE BY THE MAKERS OF GOODYEAR TIRES

THE GREATEST NAME IN RUBBER

GOODYEAR





RELIABLE PIPE!

NATIONAL Seamless Pipe has no weld—one continuous piece of steel, pierced from a solid billet, expanded and rolled at temperatures which produce grain refinement and uniform wall strength—a balanced, homogeneous unit, unsurpassed from a manufacturing standpoint. If you have refinery piping problems where reliability is the watchword, specify NATIONAL Seamless—*America's Preferred Refinery Piping.*

NATIONAL TUBE COMPANY • • • PITTSBURGH, PA.

Export Distributors—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel Corporation Subsidiary

NATIONAL SEAMLESS

A. C. S. San Francisco Meeting Plans Completed

THE program for the ninetieth meeting of the American Chemical Society has been completed. The St. Francis Hotel, San Francisco, has been designated as headquarters for the meeting when it opens August 19 to continue through August 23. The Hotel Sir Francis Drake has also been designated as an official hotel and some of the sessions will be held there. The council meeting will be held at the St. Francis Hotel at 9:30 Monday morning, August 19. General meetings, divisional meetings and group luncheons are scheduled throughout the week until Friday at which time there will be a boat ride and luncheon on San Francisco bay and visits to nearby industrial plants. E. C. Franklin is honorary chairman of the local committee in charge of arrangements and a luncheon is to be served in his honor on the opening day. Arthur Lachman, Department of Chemistry, University of California and developer of the Lachman zinc chloride treating process, is general chairman and P. D. V. Manning is secretary.

The Hawaiian Section has arranged for a post-convention tour to Hawaii and members making this tour will sail from San Francisco August 24 and will leave Honolulu on September 7 for the return trip.

The program follows:

Joint Symposium with the Divisions of Gas and Fuel Chemistry and Industrial and Engineering Chemistry.

Hans Tropsch, C. L. Thomas, and Gustav Egloff. The Pressure Pyrolysis of Paraffiin Hydrocarbon Gases.

H. B. Hass, E. T. McBee, and Paul Weber. Syntheses from Natural Gas Hydrocarbons. III. Factors Affecting Yields of Isomeric Monochlorides and Dichlorides in the Chlorination of Paraffins.

H. B. Hass, E. B. Hodge, and B. M. Vanderbilt. Syntheses from Natural Gas Hydrocarbons. IV. Nitration of Gaseous Paraffins.

W. Z. Friend and T. W. Legatski. Industrial Utilization of Propane and Butane.

Bruce B. Farrington and W. N. Davis. The Structure of Lubricating Greases.

E. N. Klemgard. Laboratory Service Testing of Automotive Lubricating Greases.

Miroslav W. Tamele and Lloyd B. Ryland. Potentiometric Determination of Mercaptans.

V. Zahn. A Modification of the A. S. T. M. Lamp Method for the Determination of Sulfur.

R. P. Tucker. The Chemical Properties of Petroleum Oil Unsaturates Causing Injury to Foliage.

Business meeting.

L. C. Snider and B. T. Brooks. The Coming Shortage of Petroleum in the United States and Some of Its Probable Effects.

Sidney Charles Singer, Jr., Roy Russell Wilson, and George Granger Brown. Design of Fractionating Columns. III. Number of Plates for Petroleum Columns.

A. C. Bratton, Jr., W. A. Felsing, and J. R. Bailey. Amplified Distillation: A High-Efficiency Method Applicable to Certain Classes of Compounds.

J. C. Morrell, C. G. Dryer, C. D. Lowry, Jr., and Gustav Egloff. Mechanism of Gum Formation in Cracked Gasoline. II. Composition of Gum.

J. C. Morrell, W. L. Benedict, and Gustav Egloff. Photochemical Formation of Color, Haze, and Reaction Products in Hydrocarbons.

K. M. Watson, Jerome L. Wien, and George B. Murphy. High-Temperature Viscosities of Liquid Petroleum Fractions.

Ulric B. Bray and W. H. Bahlke. Propane Processes for Refining of Lubricating Oils: I. Deasphalting.

The Look Box

(*Continued from page 372*)

Cracking License Agreement Announced

GASOLINE Products Company and Sun Oil Company announce that they have entered into a new license agreement pertaining to the cracking patents of the two companies.

Sun Oil Company was one of the first users of the Cross process under license from Gasoline Products Company, granted in 1922. Under the new agreement Sun Oil Company has acquired from Gasoline Products Company a broad immunity and Gasoline Products Company has obtained the right to grant immunities under the cracking patents of Sun Oil Company.

No announcement was made as to Sun Oil Company patents or as to the monetary consideration, but it is understood that substantial cash payments are being made to Gasoline Products Company and that Sun Oil Company has successfully developed and patented an important once-through type of process which will hereafter be available to the licensees of Gasoline Products Company.

Conventions

A. C. S. The American Chemical Society meets at San Francisco, California, August 19 to 24.

S. A. E. The Society of Automotive Engineers will meet at Cleveland, Ohio, September 18-19.

N. P. A. The National Petroleum Association, September 18-20, will hold its annual meeting at Atlantic City.

A. G. A. The American Gas Association, Manufacturers Division, will meet at Atlantic City, October 14 to 18.

N. S. C. National Safety Council holds the twenty-fourth annual Safety Congress, in Louisville, Kentucky, October 14-18.

I. P. A. Independent Petroleum Association will hold its 6th annual meeting at Dallas, Texas, November 4 and 5.

A. P. I. The American Petroleum Institute will hold its 16th annual meeting at the Biltmore Hotel, Los Angeles, November 11-14.

C. N. G. A. The California Natural Gasoline Association holds its meeting the first Thursday of every month in the Richfield Building, Los Angeles, California.

Louisiana-Arkansas Refiners Association, Technical Division holds monthly technical group meetings the second Friday of each month at announced meeting place.

Petroleum Products Discussed at A.S.T.M. Meet

AT the session of the 1935 A. S. T. M. annual meeting in Detroit which was devoted to rubber and petroleum products, two interesting papers on oil consumption were given—one, by Davis and Best, Continental Oil Company, covered the effect of volatility; the other by M. O. Teetor, The Perfect Circle Company, stressed the influence of engine design on oil consumption.

Davis and Best by an extensive series of tests attempted to isolate the effects of volatility and viscosity. A series of S. A. E. No. 30 oils were prepared from the same crude having similar viscosity but widely different volatility characteristics. These oils were tested for relative consumption on a four-cylinder engine-dynamometer assembly at speeds and temperature conditions similar to 40, 50, and 60 m.p.h. The results show a wide difference in consumption due to volatility, indicating that volatility is a more important factor of consumption than has hitherto been thought.

Teetor in his paper indicated that many elements of engine design affect oil consumption. Most of the elements are known but the extent of their individual or combined influence is not very well known. The paper discussed the following subjects and their relation to the control of oil consumption: Oil leaks, cylinder lubrication, theory of oil film action on cylinder walls, piston and ring designs, cylinder distortion, temperatures and finish.

Committee D-2 on Petroleum Products and Lubricants presented its annual report and also had an excellent series of meetings of sub-groups and the main committee. The activities of the technical committees and sub-committees were devoted largely to planning work for the forthcoming year and considering editorial and minor changes in the descriptions of proposed revisions and tentative revisions of standards.

Technical Committee B on Motor Oils created two new sections for the study of "Extreme Pressure Lubricants" and the "Oiliness of Motor Oils" and a new sub-committee was formed to develop test methods which are peculiarly applicable to plant spray oils.

The coordinating Section on Diesel Fuel Oils, of Technical Committee C on Fuel Oils (Including Diesel Fuel), proposed revisions and deletions in the Diesel-Fuel Oil Classification which was published last year for information. The modifications are to be disseminated to the membership of Technical Committee C and Committee D-2.

The Sub-Committee on Specific Gravity made minor changes in the description of the test for gravity by means of the hydrometer (D 287-33) which will be submitted to letter ballot for adoption as a tentative revision.

The draft of the proposed tentative revisions of the Standard Methods of Test for Viscosity of Petroleum Products and Lubricants (by means of the Saybolt viscosimeter) (D 88-33) was subjected to further minor changes and refinements. The modifications were adopted, subject to letter ballot.

The Sub-Committee on Natural Gas-

oline has prepared a tentative method of test for the vapor pressure of motor and aviation gasoline (Reid method) which will be formally submitted to the membership of the commitee for approval this year.

The annual dinner of the committee was given in honor of Dr. George W. Gray of The Texas Company. The toastmaster was R. R. Mathew. In responding to the presentation of a testimonial gift, Doctor Gray related a number of interesting incidents pertaining to the testing of petroleum products at the time he was first associated with the industry. Enlightening talks were presented by T. A. Boyd and Dr. L. C. Beard on the effect of the automobile industry upon the petroleum industry and vice versa.

New officers of the association announced at the meeting were as follows:

H. S. Vassar, laboratory engineer, in charge of testing laboratory, Public Service Electric & Gas Company, Irvington, N. J., succeeded Doctor von Schrenk as president; Prof. A. E. White, University of Michigan, was chosen junior vice president to serve with A. C. Fieldner, U. S. Bureau of Mines, who became a vice president in 1934.

It was announced that the 1936 annual meeting of the society would be held in Atlantic City, from June 29 to July 3, inclusive.

FORGED STEEL FITTINGS

SIZES
1/8" to 6"
Inclusive

CROSSES, ELLS, TEES, UNIONS, BUSHINGS, PLUGS and COUPLINGS

PRESSURES:
(Cold Working)

3000 and 6000 pounds

3000-pound fittings are recommended for 1350-pound pressure at 900° F.

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National Metal Congress Chicago, September 30

OUTSTANDING leaders in the metal world will take an active part in the technical program for the Seventeenth National Metal Congress and Exposition, to be held in Chicago the week of September 30.

This was indicated today with the program for the five cooperating societies almost completed. The societies participating in this year's metal show are the American Society for Metals, the American Welding Society, the Wire Association, and the Institute of Metals Division and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

In the course of 40 morning and afternoon sessions during the five-day period, more than 75 papers dealing with every phase of the metal industry, will be presented. Over 100 subjects will be discussed by men whose names are synonymous with the latest developments in the science and art of metals.

Headquarters for the congress will be maintained at the Palmer House, where morning sessions will be conducted. Afternoon sessions will be held at the New International Ampitheatre, where the exposition will be located.

Chemical Industries Fifteenth Exposition

INDICATIVE of the growing world demand for chemical equipment, the findings of a survey just completed by the Bureau of Foreign and Domestic Commerce, Washington, D. C., prove naturally accordant the many advance requests for space at the 15th Exposition of Chemical Industries. The exposition will be held during the week of December 2-7, 1935, at Grand Central Palace, New York City. The many new chemical plants established during 1934, shown by the survey, are good omens of universal interest in plant modernization, and a sign that the chemical exposition will meet a current need. To the fourteenth exposition, held in 1933, visitors came from 938 cities and towns of 42 states of the United States and from 69 cities and towns of 27 foreign countries, making the total registered attendance 34,269—an increase of 50 percent over the previous exposition. The fourteenth exposition took place when the pulse of industry gave only vague indications of its slow return to normal.

Now, in 1935, $100,000,000 have been set aside for new plant projects in the chemical industries. R. E. W. Harrison, chief of the Commerce Department's Machinery Division says, "There is a growing market for machinery of the type suitable for use in plants manufacturing chemicals and allied products, including heavy chemicals, paints, and paint products, pharmaceuticals, toilet requisites, plastics, etc. Almost every country in the world is busy establishing such factories, or modernizing and extending old plants, and many of them have to look to other countries for their machinery requirements."

Exhibits at the exposition will be specially grouped as: general equip-

ment; chemicals and chemical products; plastics, molded products, and lacquers; laboratory equipment and supplies; instruments of precision; containers and packaging equipment; brewing, distilling and bottling; materials handling equipment; raw materials, natural resources and industrial opportunities; and educational instructional exhibits. To the exhibitor, the exposition will offer the opportunity of showing his products attractively, intelligently, and economically to a great interested audience. To the visitor, the exposition will offer the opportunity of comparing competitive products side by side, to study the latest designs and materials, and to discuss his problems with the exhibiting companies' complete technical staff.

Oil Burner Institute Formed

AT a two-day meeting held in Cleveland on July 9 and 10, attended by the key manufacturers in the oil burner industry and presided over by W. J. Smith, president of the American Oil Burner Association, and vice president of the Cleveland Steel Products Corporation, the creation of Oil Burner Institute to succeed American Oil Burner Association and the adoption of a broad gauge program was unanimously voted.

The new program contemplates a broadened membership to include all manufacturers of oil burning appliances in the United States and the inauguration of detailed plans which will exert a stimulating influence of far reaching benefits to oil producers and refiner as well as to the oil burning appliance manufacturers themselves.

Present members of American Oil Burner Association automatically will become members of the new Oil Burner Institute.

Gasoline Association Meeting Dates Announced

THE Natural Gasoline Association of America has announced that its 15th annual convention will be held at the Mayo Hotel, Tulsa, Oklahoma, May 13, 14, and 15, 1936. This meeting immediately proceeds the International Petroleum Exposition and Congress, at Tulsa, May 16 to May 23.

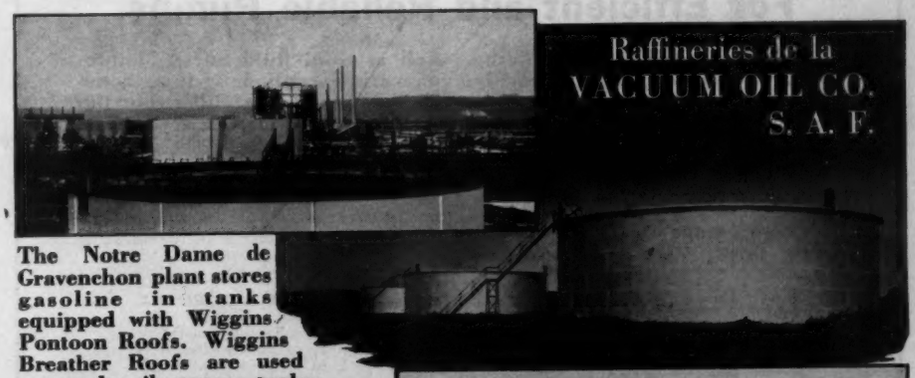
Refining Wastes for Low-Cost Highways

A PLAN to promote conservation of natural petroleum resources by building economical highways is being placed before highway commissioners and engineers by the Low Cost Roads Association of Kansas City, Missouri.

The plan, based upon complete utilization of all products of petroleum, calls for the use for highway improvement of the asphalts and road oils left as residual products in the manufacture of motor fuels and lubricants.

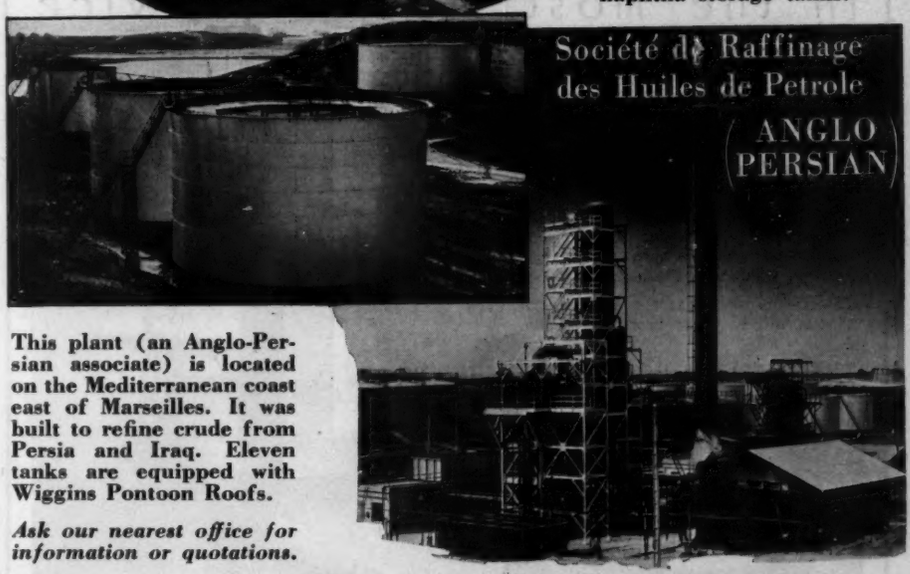
"The refining process which produces gasoline and lubricating oils also produces road oils and asphalts," it was explained by Secretary G. E. Everett. "When the motorist can consume petroleum products in his car driving over a highway paved with petroleum products, we have true conservation of petroleum resources. This

LEADING FRENCH REFINERIES
USE
WIGGINS PONTOON ROOFS to STOP EVAPORATION



The Notre Dame de Gravenchon plant stores gasoline in tanks equipped with Wiggins Pontoon Roofs. Wiggins Breather Roofs are used on crude oil storage tanks.

Eight 120 ft. diameter crude oil storage tanks at this refinery located at Port Jerome, France, are equipped with Wiggins Pontoon Roofs. In addition, Wiggins Pontoon Roofs are used on eighteen naphtha storage tanks.



This plant (an Anglo-Persian associate) is located on the Mediterranean coast east of Marseilles. It was built to refine crude from Persia and Iraq. Eleven tanks are equipped with Wiggins Pontoon Roofs.

Ask our nearest office for information or quotations.

CHICAGO BRIDGE & IRON WORKS

Dallas	1255 Dallas Athletic Club Bldg.	Cleveland	2234 Rockefeller Bldg.
Houston	2919 Main Street	New York	3302-165 Broadway Bldg.
Tulsa	1626 Thompson Bldg.	Philadelphia	1608-"1700" Walnut St. Bldg.
Birmingham	1548 Fiftieth Street, N.	Boston	1529 Consolidated Gas Bldg.
Chicago	2463 Old Colony Bldg.	San Francisco	1051 Rialto Bldg.
Detroit	1520 Lafayette Bldg.	Los Angeles	1334 Wm. Fox Bldg.

Plants in Chicago, Birmingham and Greenville, Pa.

QUIMBY PUMPS

Meet Solvent Refining Needs For Efficient and Reliable Pumps

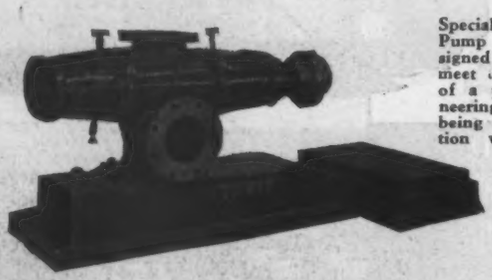
Quimby ROTEX and Quimby SCREW Pumps! Each has only two moving parts, rotating cams in the ROTEX and interlocking screws in the SCREW Pump. Neither has any metal-to-metal contact. Parts are driven by external timing gears.

These pumps are ideal for handling thick, viscous products as well as thin, fluid ones. Maintenance is exceptionally low. Some of the pumps are still using the original parts after 25 years of service.

QUIMBY PUMP COMPANY

342 THOMAS ST. NEWARK, N. J.

Offices in Principal Cities in the United States and Canada



Special type ROTEX Pump recently designed and made to meet the specifications of a prominent engineering firm. It is now being used in connection with de-waxing.

FOR LOW-COST PUMPING OF WAXES OILS, DISTILLATES AND GREASES

A FULTON is at Home in the most modern service

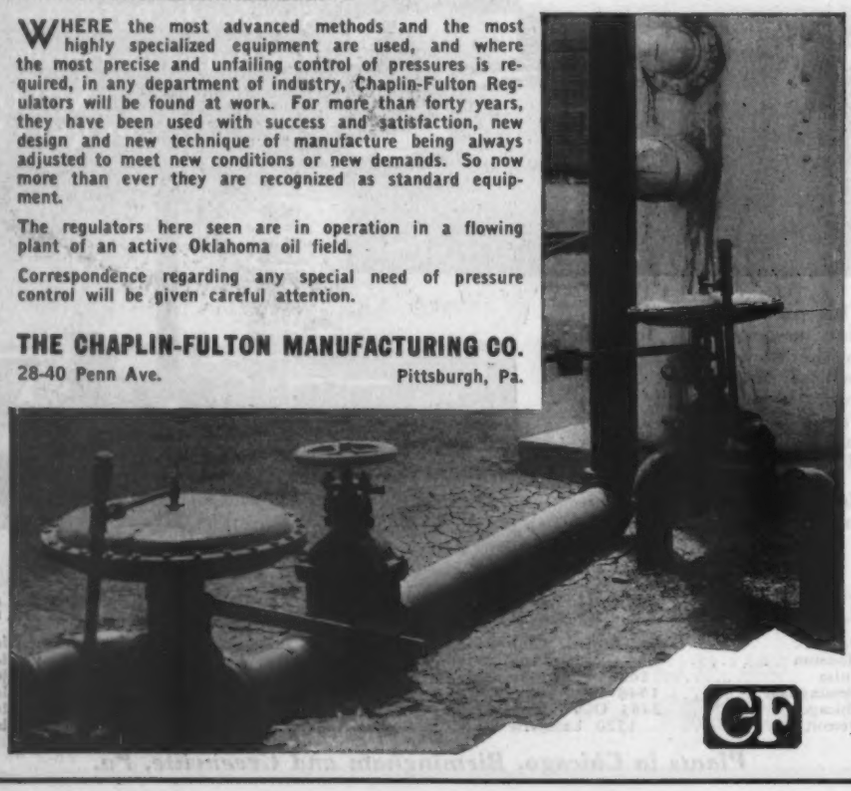
WHERE the most advanced methods and the most highly specialized equipment are used, and where the most precise and unfailing control of pressures is required, in any department of industry, Chaplin-Fulton Regulators will be found at work. For more than forty years, they have been used with success and satisfaction, new design and new technique of manufacture being always adjusted to meet new conditions or new demands. So now more than ever they are recognized as standard equipment.

The regulators here seen are in operation in a flowing plant of an active Oklahoma oil field.

Correspondence regarding any special need of pressure control will be given careful attention.

THE CHAPLIN-FULTON MANUFACTURING CO.

28-40 Penn Ave. Pittsburgh, Pa.



CF

plan is particularly effective because taxes paid on the gasoline consumed on each highway would more than meet the cost of paving with the by-products of gasoline manufacture.

"Improvements in highway design have made it unnecessary to spend $25,000 a mile for narrow slab pavement. Wider, and safer, highways can be built with petroleum surfacing for $5000, or less, per mile. The farmer can be taken out of the mud with oiled roads costing $1000, or less, per mile.

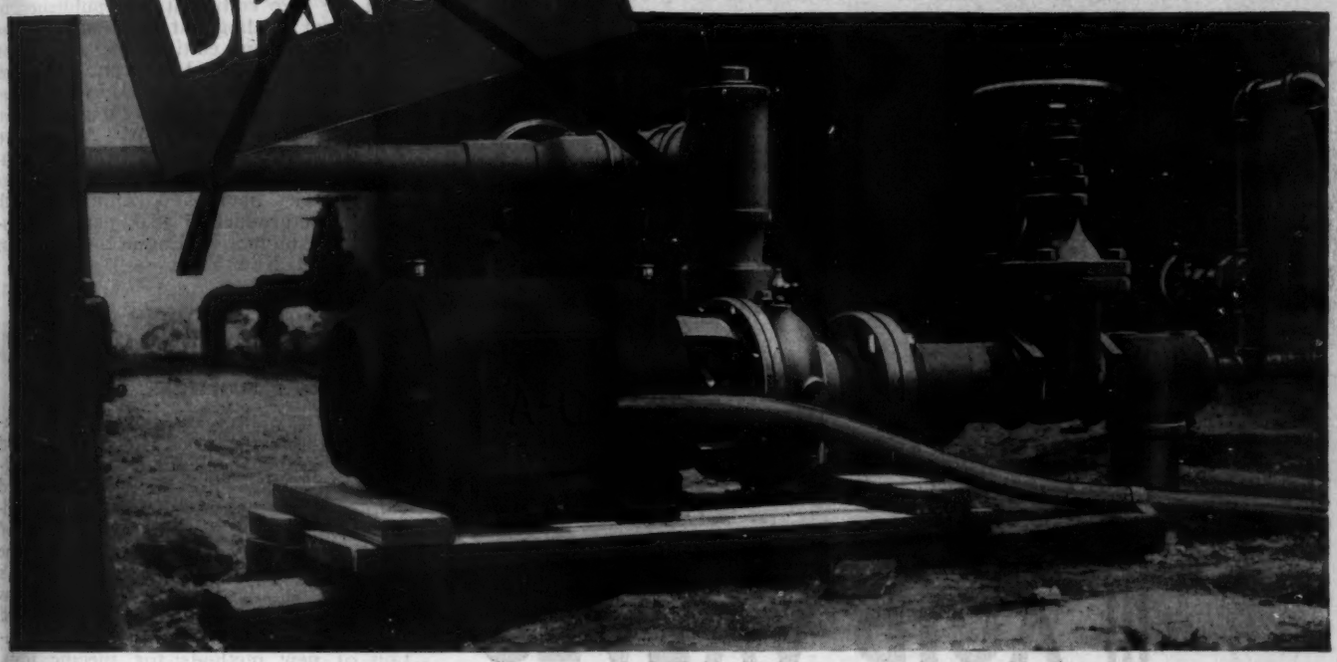
"The petroleum industry has submitted to burdensome taxation of its major products to finance good roads. Motorists have paid more than $4,000,000,000 in gasoline taxes in the last 15 years, yet only about 300,000 miles of road have been even improved. For that amount 3,000,000 miles of economical highway could be built and the limited and dangerously congested mileage of our present road system be expanded and made safe."

SIDNEY S. SMITH, for several years superintendent of manufacturing in the Mid-Continent division of Shell Petroleum Corporation, was transferred from Tulsa to St. Louis July 15 to become assistant to R. B. High, general manager of manufacturing. In his new position Smith will

SIDNEY S. SMITH

continue his research work in the natural gas gasoline field and will direct the tecnical work in both the Mid-Continent and Texas Gulf Coast areas. The change was part of a reorganization plan, whereby all natural gasoline plants of the company will be under direct supervision of the superintendents of production in the districts in which they are located. R. E. Baker, who has been chief chemist in the Mid-Continent division, has been named technical advisor in that area. Smith has been one of the most active members of the Natural Gasoline Association of America, having served as its president for two terms. He has appeared on a number of programs of the association and is author of several papers published by the technical press.

A *DANGEROUS* place made *SAFE!*



This motor is part of an Allis-Chalmers type SSU combination motor and pump unit transferring gasoline to tank trucks in a California refinery. No building or fire walls are necessary.

Allis-Chalmers Explosion-proof Motors are safe in gasoline laden atmosphere. They solve the problem of driving pumps and other equipment in locations that would be dangerous with ordinary motors or where fire walls would be necessary.

No flame can escape from the motor. Its simple construction makes it readily accessible. Allis-Chalmers Explosion-proof Motors are approved by the Underwriters' Laboratory for Class 1, Group D locations (gasoline, pyroxlin lacquer vapor).

ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

Products for the Petroleum Industry

Single Reduction Oil Well Units
Industrial and Field Tractors . .
Centrifugal Pumping Units . .
Pipe Line Pumps . . . . .
Vibrating Mud Screens . . .
Blowers and Compressors . .
Motors and Control . . . .
Direct Current Drilling Rigs . .
Texrope Drives . . . . . .

ALLIS-CHALMERS MOTORS

Underwriters' Laboratories INSPECTED MOTOR FOR HAZARDOUS LOCATION ELEC. 0152 CLASS I GROUP D NO. L

S. A. E. Handbook Revised and Enlarged

CONTAINING in definitive form results of three important Society of Automotive Engineers' standards projects completed during the year 1934 and many other important revisions and additions, the 1935 edition of the S.A.E. Handbook is being distributed. Most of the edition of 7000 has gone to members of the society in nearly every country of the world.

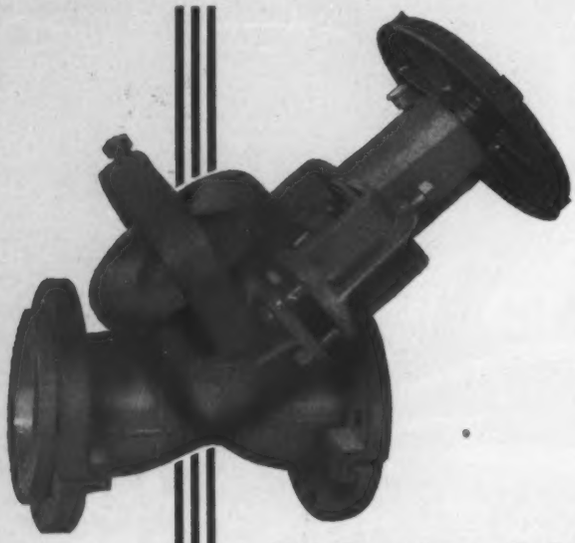
Of the new material in the Handbook, perhaps the most important inclusion is a complete revision of the Iron and Steel Specifications and the Non-Ferrous Metals Specifications. The last complete previous revision in these categories was made in 1922. Progress in the art since that time required that the Iron and Steel Division of the S.A.E. Standards Committee spend over a year in complete revision and modernization of specifications, chemical compositions, and heat-treatments in order to produce a new epitome of the subject which shall be of maximum benefit.

Other new material in the Handbook includes revised tables of screw threads and bolts and nuts which have been established as American Standard under the sponsorship of the S.A.E. and the A.S.M.E. New specifications have been set up for the straight 8, 12, and 16-thread-per-inch classifications covering Class 2 and 3 fits in the 8 to 12 pitch series and Class 3 fits in the 16-thread series. There has been added to this group a series of valuable tables covering special pitched threads in Class 2 and 3 fits and thread diameters from No. 10 to 1½ inches inclusive.

Data have been included covering the oval diameters for tanks on fuel tank trucks. These data have been added as a result of a cooperative project with the American Petroleum Institute and a Committee of the Tank Manufacturers.

The complete report of the Automotive Transportation Code Committee has been published in the 1935 edition of the Handbook as a guide in connection with motor-vehicle regulatory and similar matters.

The new edition contains 672 text pages and 24 pages of index. First published in 1911 the S.A.E. Handbook was then issued in loose-leaf pamphlet form. Beginning with the 1926 edition it was published in permanent binding but in a smaller size than the present edition, the format of which was established with publication of the 1933 edition. Distribution of the Handbook is not limited to the automotive industry. The Society of Automotive Engineers has in its files letters indicating the use of S.A.E. standards in scores of industries having no connection with automotive production. $5.00 per copy, Society of Automotive Engineers, 29 West 39th Street, New York.



ACID VALVES

Developed for the chemical industry by a company which for years has been familiar with the moving of processed liquids, LaBour Chemical Valves have amply demonstrated their stamina and the economy of their use. The increasing use of various acids in refining processes places greater and greater importance upon the selection of the handling equipment. LaBour Valves for use with acid are a safe choice.

Standard materials used in LaBour Chemical Valves are suitable for most of the acids outside the chlorine group, and practically all caustics. To meet special conditions, valves of the LaBour construction can be furnished in various alloys and combinations.

LaBour engineers will be glad to help you with your problems in controlling the flow of acid. There is no cost or obligation when you submit your problems to them.

ORIGINATORS OF THE SELF-PRIMING CENTRIFUGAL PUMP

THE LABOUR COMPANY, Inc.
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Testing Petroleum And Its Products

THE Institution of Petroleum Technologists, Aldine House, Bedford Street, Strand, London, W. C. 2, England, announces publication of the third edition of the institute's handbook "Standard Methods for Testing Petroleum and Its Products." Since publication of the second edition in 1929 the institution's Chemical Standardization Committee has been actively engaged in consideration of the existing methods and in the investigation of new methods for specific tests. The results of this committee's work are incorporated in the new edition of the handbook, which contains nearly 100 pages more than the previous book. Among the new tests are those for greases (ash, consistency, drop point, free alkali and acid) knock-rating, existent and potential gum in motor fuels, cost test of motor fuels, dilution of crankcase oil, vapor pressure, tests for liquid asphaltic bitumen and viscosity in kinematic units.

A new section has been included for tentative methods and contains details of tests which are required but regarding which further experience is necessary before they can be considered as standard. Copies of the book can be obtained from the Institution, price 7s. 6d.

Hydrogen Sulphide Detector

THE Bureau of Mines has issued Report of Investigation, R. I. 3276 which deals with "A Detector for Quantitative Estimation of Low Concentrations of Hydrogen Sulphide" by J. B. Littlefield, W. P. Yant and L. B. Berger. The 13-page bulletin deals with the need for, the uses of, and means of fabrication of a suitable testing apparatus which is low in cost, simple in operation and with which tests for hydrogen sulphide can be completed in one minute. Copies can be secured free by writing Section of Publications, Bureau of Mines, Washington, D. C.

Petroleum, The Story of An American Industry

"PETROLEUM, The Story of an American Industry" is a second and larger edition of the book "Oil" which was published by the American Petroleum Institute in 1930. The purpose of the book is to tell, in simple terms, an understandable story of the American petroleum industry's services and operations and of its economic contributions to society. The book contains the following chapters: What Is Petroleum?; Petroleum History; A World Industry; The American Industry; Discovery and Production; Transportation and Storage; Petroleum Refining; Petroleum Marketing; Gasoline the Modern Fuel; Use of Petroleum Products; Petroleum Taxation; and Petroleum Conservation.

The price of the book is 15 cents per copy with lower prices for quantity orders. Copies can be secured by writing American Petroleum Institute, Room 2040, 50 West 50th Street, New York.

Liquid Fuels

"LIQUID FUELS" by Harold Moore, published by The Technical Press, Ltd., 5 Ave Maria Lane, Ludgate Hill, London, E. C. 4 (Price 21 s), the third book by this author since 1917 when "Liquid Fuels for Internal Combustion Engines" was published, represents an enlargement and widening of the earlier work for the author has covered both fuel for internal and external combustion engines. The book, consisting of 265 pages, is divided into six parts. Part 1 consists of a treatment of the chemistry of liquid fuels. Following this the author deals with the preparation of liquid fuels discussing not only petroleum but shale oil, coal tars, lignite tars, carbonization of wood and peat, animal and vegetable oil, ethyl alcohol and synthetic fuels.

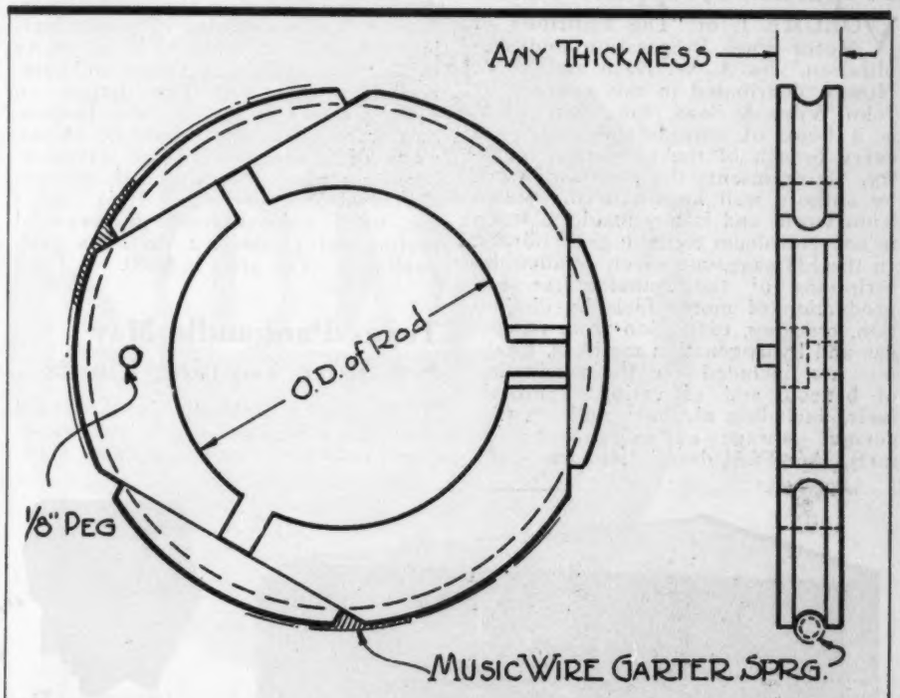
The relation between the chemical and physical properties of fuels and engine efficiency, is discussed in part 3. Part 4 is given over to fuels for internal combustion, part 5 to fuels for external combustion, and part 6 presents data on the significance of tests and analytical methods. The appendix includes graphs, charts and tables, and there is a suject index and an author index.

Petroleum: 25 Years Retrospect

THE Institution of Petroleum Technologists, Aldine House, Bedford Street, London, W. C. 2, England, has just published a new interesting and valuable book tracing the history and development of all phases of the petroleum industry during the past 25 years (1910 to 1935) under the title "Petroleum, 25 Years Retrospect." In its more than 20 chapters will be found much of interest to those feeling the need of correlated reference to the rapid development of the petroleum industry during recent years. Of especial interest to the refining branch of the industry are the following chapters: The Economics of the Petroleum Industry, by Sir Robert Waley Cohen; Distillation, by F. H. Garner; Cracking, by S. J. M. Auld; Refining and Treating, by A. E. Dunstan; Transportation and Storage of Oil, by A. C. Hartley; Storage Installations, by H. D. Demoulins; Distribution of Petroleum Products, by M. B. Davy; Chemistry of Petroleum, by F. B. Thole; Tests of Petroleum and Their Standardization, by S. E. Bowrey and George Sell; Fuel Developments for Internal Combustion Engines, by C. H. Barton, C. H. Sprake and R. Stanfield; Natural Gas, by J. Kewley; Chemical Intermediates and Special Products from Petroleum, by A. W. Nash; Asphaltic Bitumen and Asphalt, by E. M. Bailey and George Granty; The Scottish Shale Oil Industry, by E. M. Bailey and George Grant, and The Production of Oil From Coal, by F. S. Sinnatt.

Internal Combustion Engines

UNDER the sponsorship of The American Petroleum Institute and the State Departments of Industrial Education of Texas, a 157-page book "The Care and Operation of Internal Combustion Engines" has been prepared for one of the vocational training courses, Petroleum Industry Series. The text is designed to give operators or prospective operators of internal combustion engines, information which will help them to operate and maintain various types of gas, gasoline, and oil engines. In the first chapter the principles of two- and four-cycle engines is explained, and constructional details are treated. Illustrations are used freely to clarify description. Lubrication, igni-



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tion, cooling, installation, and repairs are covered in separate chapters. Safe practices and trouble analyses are stressed throughout. A separate chapter deals with the principles of diesel and semi-diesel engines. Operating problems are discussed and methods of making adjustments and repairs described. Throughout its preparation the practical operator has been kept in mind. Theoretical discussions have been limited to what seemed necessary for an understanding of fundamental principles. Copies of this text can be secured from the Bureau of Industrial Teacher Training, Division of Extension, University of Texas, Austin, Texas, and the price is $1.00 per copy.

Principles of Motor Fuel Preparation, Application

VOLUME 1, of "The Principles of Motor Fuel Preparation and Application," by A. W. Nash and D. A. Howes, distributed in this country by John Wiley & Sons, Inc., New York, is a book of considerable utility to every branch of the petroleum industry. It represents the results of work by authors well known in the petroleum world and is a valuable addition to any petroleum technologists' library. In the 538 pages are given detailed descriptions of the manufacturer and production of motor fuels by distillation, cracking, extraction from natural gas and hydrogenation methods. Chapters are included on the production of benzole and of various synthetic fuels, including alcohols, and on the general storage and distribution of fuels. Amplified descriptions are given of refinery methods, of the production of benzole and of hydrogenation processes. The preparation, production and utilization of alcohol fuels are treated, and a section is included devoted to synthetic fuels. Other auxiliary supplies of motor fuels also are described. The book is elaborated with sectional diagrams, photographs, and references to literature, the latter being appended advantageously at the end of each chapter. Publication of the second volume is to follow soon.

Although the subject is one that has been treated by several other authors, it continues to be of real interest because of the rapid developments in motor fuel technology. The numerous specifications of motor fuel properties and the extensive index of current literature constitute a valuable record of developments during the past decade. The chapter on refining of motor fuels is particularly valuable. The extensive subject is organized in a clear and comprehensive manner. The chapter on hydrogenation is also of value because so few complete and organized discussions of hydrogenation are available. The complete indexing of patents should also be of value. It is one of the most comprehensive surveys of motor fuel production that has been published. The price is $8.00.

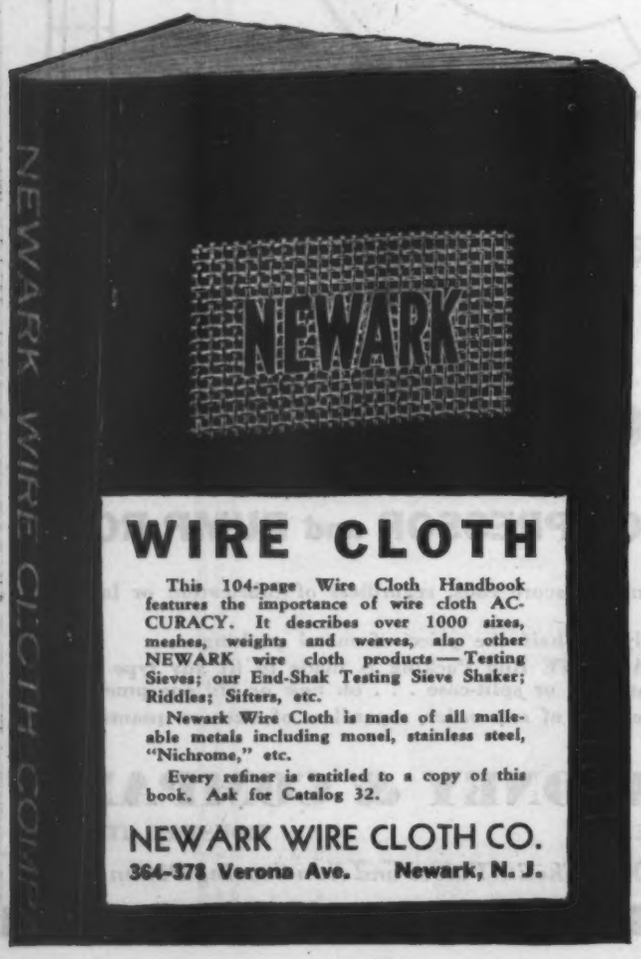
Texas Panhandle May See More Topping Plants

THE Texas Panhandle is threatened with a second invasion by the "mushroom" class of crude topping plants. Many wells in Gray and Wheeler Counties have been waiting for pipe line connections since last May, after drilling to the top of the oil horizon, and no immediate market relief is in sight, owing to the purchasing companies being content with serving their existing well connections.

Operators of crude skimming plants in East Texas are known to be casting an eye on the Panhandle situation, due to the opportunities for an adequate supply of high gravity crude at what they term "satisfactory price arrangements." Crude production restrictions in the Panhandle assessed by the Railroad Commission are largely dependent upon the pipe line companies for enforcement, and no tenders are required by the federal authorities for interstate shipments of refined products turned out by plants in the district.

More than a score of wells in the western Wheeler County section of the Panhandle have been standing from four to six weeks on top of the prolific granite wash pay because of pipe line companies refusing to make connections.

BUELL ENGINEERING COMPANY, Inc., 70 Pine Street, New York, has been organized to build two classes of apparatus in America as follows: The Buttner drying systems of the rotary, turbo and fine-film type and the Van Tongeren system of dust extraction for fly-ash from stack discharge and collection of dust from industrial plants. Burners and pulverizing sets for power and industrial grinding are also to be made. Units will be manufactured by Struthers-Wells-Titusville group which is associated with the new company.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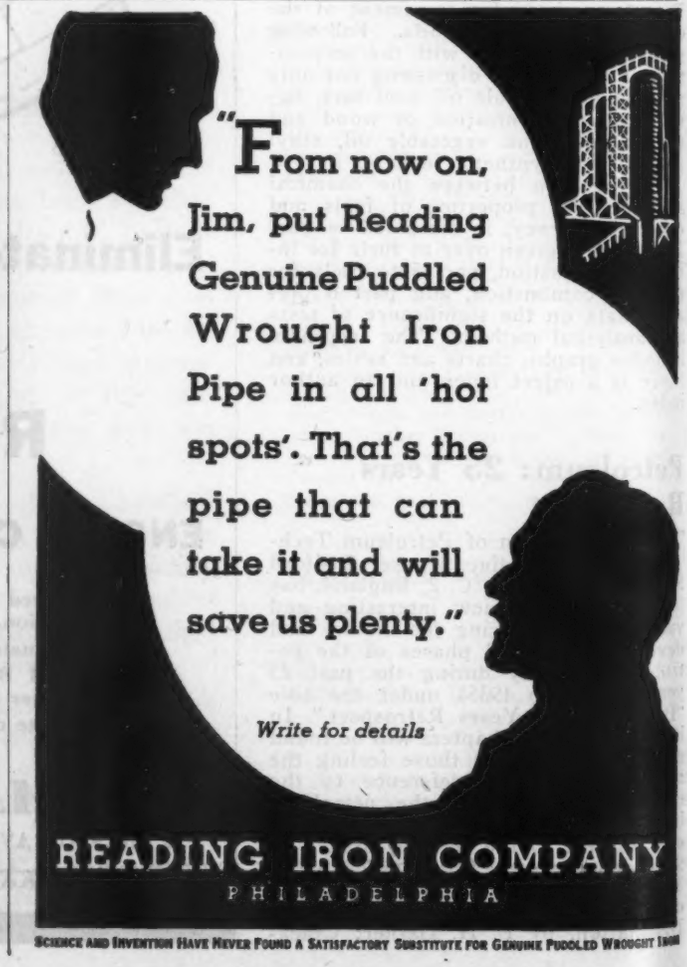
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▼ PLANT ACTIVITIES ▼

Improvements: Standard Oil Company of California has completed its $2,250,000 improvement program begun earlier this year, which involved erection of a combination atmospheric and vacuum distillation unit, a major program of modernization of cracking units, solvent treating system, gasoline recovery unit, lubricating oil vacuum rerun unit, wharfage facilities and booster plant.

Improvements: Anglo-Iranian Oil Company, Ltd. (formerly Anglo-Persian) at its Abadan, Iran, refinery is installing a 35,000-barrel two-stage atmospheric and vacuum distillation unit and a 12,000-barrel stabilization system. Contract to Alco Products, Inc. Further additions are planned. The company's new refinery at Kermanshah is expected to start operating this fall. Cracking plant and new equipment for manufacture of lubricants are being installed at the Duoai refinery of the associated company in France.

Cracking: Appolo Mineraloel Raffinerie A. G. at Bratislave, Czechoslovakia, near Vienna, will build a Dubbs cracking unit with construction work contracted to Skoda, who will furnish a large part of the equipment and materials. Unit will be two-coil type with capacity from 900 to 1100 barrels per day depending upon charging stock.

Solvent Dewaxing: Continental Oil Company, Ponca City, Oklahoma, plans to add a solvent dewaxing unit in the near future. The unit will finish 400 barrels of dewaxed oil daily, and will use the Barisol process employing ethylene dichloride and benzol as solcents.

Refinery: Solvex Refineries, Inc., Gladewater, Texas, which recently purchased the refineries of the Culver interests, plans immediate erection of a modern Dubbs cracking unit. Contracts for erection have been let through Frick-Reid Supply Company and through Burrell-Mase Engineering Company. Capacity, 2500 barrels.

Operating: Canadian Oil Companies, Ltd., Petrolia, Ontario, Canada, has began operating its new $425,000 refinery, which includes skimming, cracking unit and gasoline recovery system. Laboratory and office building now are under construction, as are terminal tankage, and auxiliary generator plant. Company is a subsidiary of National Refining Company, Findlay, Ohio.

Refinery: Valley Port Refining Company, recently organized by G. L. Rowsey and associates, is reported planning erection of a 5000-barrel refinery on the Port Isabel turning basin, near Brownsville, Texas. Contract for much of this refinery equipment, and for equipment for affiliated pipe line company and terminal company has been let to Wyatt Metal and Boiler Works, Dallas and Houston.

Refinery: Pettus Oil & Refining Company has been formed by Morris Roberts, president, G. A. Ray, Jr., and W. D. Walton, all of Pettus, Texas, and plans erection of a 1000-barrel topping plant near Mathis, Texas, to operate on Dinero crude, Live Oak County, 10 miles away. A pipe line from the field is contemplated. Roy Mechen, chemist, is to be superintendent.

Refinery: Standard Oil Company of California, through subsidiary Standard Oil Company of British Colombia, has let contract to Alco Products, Inc., for erection of a 2500-barrel topping unit and other equipment for its New Baranaby refinery, recently announced.

Improvements: Shell Petroleum Corporation, Wood River, Illinois, is erecting a new stabilizer with capacity of 6000 barrels per day, to operate in conjunction with its T. V. P. cracking unit, and a new absorption system to handle 20,000,000 feet of gas daily. At the Houston plant, Shell Petroleum Corporation is erecting a new crude prestabilization system with capacity of 44,000 barrels daily. Contracts to Alco Products, Inc.

Distillation: Crown Central Petroleum Corporation, Houston, has let contract to Alco Products, Inc., for installation of a two-stage atmospheric and vacuum distillation unit to replace other equipment used for purposes of distillation.

Distillation: Pennzoil Company, Oil City, Pa., has let contract to Alco Products, Inc., for construction of a new 4000-barrel topping plant to replace battery of shell stills.

Gasoline Plant: Carter Oil Company,

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Tulsa, is building a new natural gasoline plant in the Fitts pool, Oklahoma, Section 30-2-7. To be completed about September 15. Capacity 25,000 gallons.

Gasoline Plant: J. E. Crosbie, Inc., and Warren Petroleum Company, Tulsa, are operating a new gasoline plant in the Fitts pool, Oklahoma, using Tulsa Type absorption and distillation system. Capacity 20,000 gallons.

Carbon Black Plant: United Carbon Company, Charleston, W. Va., represented by E. H. Shinn, Borger, Texas, is building a 25,000,000 cubic foot carbon black plant, Southwestern Hutchinson County, Texas. Location is on Sanford land, immediately south of the Canadian River. Residue gas from Phillips Petroleum Company's gasoline plant, which will switch to sour gas production from Moore County, will be used.

Cracking: Administracion Nacional de Combustibles Alcohol y Portland (A. N. C. A. P.) Montevideo, Uruguay, has let contract for its $2,500,000, 3800-barrel refinery and cracking plant. A. N. C. A. P. engineers in collaboration with engineering staffs of Universal Oil Products Company and Foster Wheeler Corporation have worked out details. Tube still is to produce gasoline, kerosene, gas oil and fuel oil. Cracking unit is Dubbs full flashing type. Units include stabilizer, absorption plant and clay treating plant.

Shale Oil Plant: A combination representing Finnish industrial interests is reported contemplating erection of a refinery in Finnland to produce gasoline from Estonian shale oil. Preliminary negotiations it is said, contemplates a concession to mine shale deposits in Estonia and to purchase shale oil plant owned by Swedish Wallenberg, a concern at Kohtla, Estonia, with plant capacity of 12,000 tons of crude annually.

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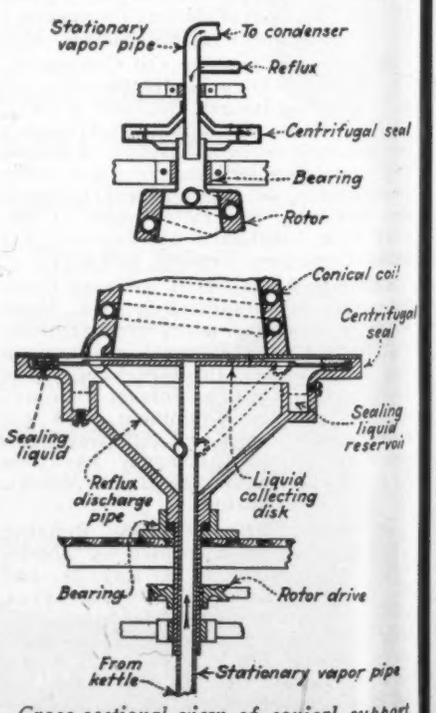
Podbielniak Super-Contacting Device

A NEW form of centrifugal apparatus for producing extremely intimate contact between fluids of different densities, to which has been given the name of centrifugal, countercurrent Super-Contactor, has recently been announced by Walter J. Podbielniak of the Podbielniak Industrial & Research Laboratories, 222 East Superior Street, Chicago. The device was described and its principles disclosed in a paper presented before the recent New York convention of the American Chemical Society. Remarkable claims have been made for the efficiency of the Super-Contactor in such diversified applications as fractional distillation, gas absorption, countercurrent contacting of immiscible liquids, as in solvent extraction, and in gas washing and cleaning.

Whereas the usual types of equipment for contacting fluids of different densities depend solely upon gravity for their separating effect, the new apparatus employs centrifugal force which can be developed to any desired degree by proper choice of the speed of rotation of the rotor, and through its suitable design. The duration of contact between the fluids can be fixed at any desired time through choosing a suitable pitch and length of passageway in the rotor and a suitable speed of rotation. If sufficient length cannot be obtained in a single rotor, it claimed that several rotors in series may be used. Thus, through the controllable combination of these two factors—separating effect and duration of contact between the



Cross-sectional view of conical support type of centrifugal fractionating device.

fluids—plus an extremely high degree of turbulence which is said to be inherent in this type of apparatus, the results that are attained are reported to be superior to those to be had with much bulkier equipment of earlier types.

One form of the Super-Contactor is illustrated in the accompanying drawing. As shown it is adapted to fractional distillation. The principal element of the apparatus is a conical rotor containing a spiral passageway, shown as circular in cross-section, but preferably square. In order that vapor may be introduced into the lower end of the coil, a stationary vapor pipe rising from the still kettle is brought into gas-tight contact with the rotor by means of a centrifugal liquid seal. A similar seal is employed at the upper end of the rotor to connect with the stationary discharge pipe. Reflux liquid which flows from the lower end of the coil is prevented by the seal from dropping into the rotating conical bottom of the apparatus, backing up on the stationary liquid collecting disk and flowing downwardly through the discharge pipes to the kettle.

The action of the equipment is as follows: When the rotor is started, the sealing liquid flows from its storage reservoirs within the rotor seals, and seals the edges of the stationary disks. Reflux liquid introduced at the top of the apparatus flows down through the coil as a thin layer which, through centrifugal action, follows the outer periphery of the coil, where it is accelerated both by gravity and by the tangential component of the centrifugal force (due to the increasing diameter of the spiral). Vapor from the still kettle, entering at the bottom of the rotor, flows upwardly through the coil and follows its inner periphery. The driving force impelling the vapor is the pressure difference between the still and the condenser, and this is opposed by the tangential component of centrifugal force against which it is working. With the use of liquid velocities of about 6 feet per second, and of vapor velocities in the neighborhood of 40 to 80 feet per second, the counterflow contact between the two phases at their interface is said to result in so high a degree of turbulence that each foot of spiral passage is equivalent to about 1-1/3 gravitational bubble plates. At the same time, the centrifugal force tending to separate the two phases is said to prevent foaming or entrainment.

Although this description applies to distillation, it is not difficult to extend these operating principles to other operations for which the equipment is adapted. In distillation, there is a continuous interchange of heat between the counterflowing streams of hot vapor and colder reflux liquid. As this occurs, the ascending vapor becomes progressively stronger in the lower boiling component, and the descending liquid, progressively stronger in the higher boiling component. Since in a single rotor it is possible to employ from 45 to 100 feet of spiral passage, it is evident that the equivalent of more than 100 plates can be included within a small volume. For example, in an apparatus of 500 gallons per hour capacity, equivalent to 100 plates, the total volume occupied is 4 by 4 by 6 feet. By multistaging rotors, the equivalent of 1000 plates can be obtained, thus making

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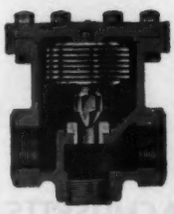

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possible separations that are totally impractical for gravity distilling apparatus.

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▼ BUSINESS NOTES ▼

FOSTER WHEELER CORPORATION announces that at a meeting of the board of directors July 22, Harry S. Brown was elected president of the corporation. Brown received his engineering degree at Cornell University and joined the Power Specialty Company in 1904. He served in its engineering and sales deparements for 15 years, becoming manager of the New England division with headquarters at Boston. In 1919 he resigned from Power Specialty Company to become vice president of Wheeler Condenser & Engineering Company. In 1927 the Power Specialty Company and Wheeler Condenser and Engineering Company consolidated to form Foster Wheeler Corporation and he became its vice president in charge of sales and a director.

HARRY S. BROWN

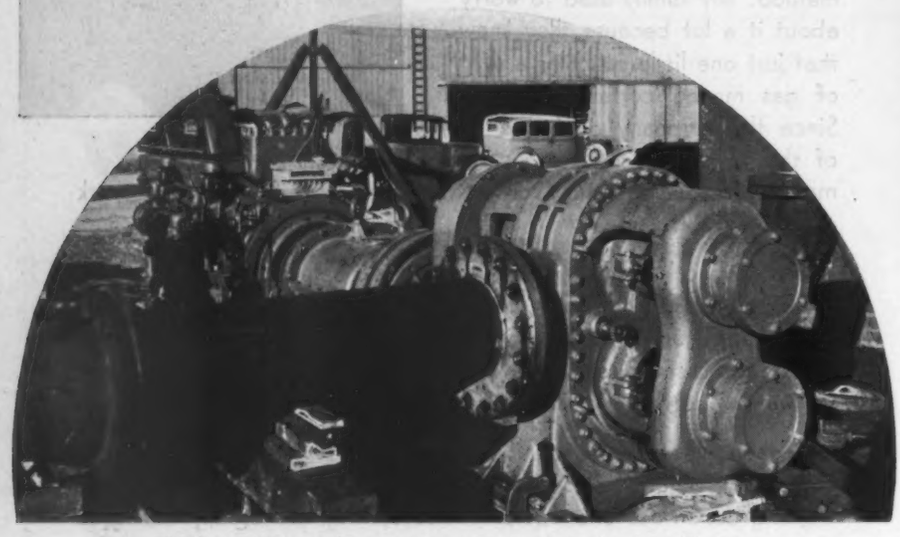
Mr. Brown succeeds his brother, J. J. Brown, as president. J. J. Brown had held both the offices of chairman of the board and president for the past two years. He resigned as president but continues actively as chairman of the board.

At the same meeting David McCulloch, formerly secretary and general manager, was elected executive vice president and Walter F. Keenan, Jr., George B. Ferrier and J. J. Nelis were elected vice presidents. P. N. Wenz was elected secretary.

COPPUS ENGINEERING CORPORATION, Worcester, Mass., announces appointment of M. N. Dannenbaum Company, Shell Building, Houston, Texas, as district representative to handle the line of Coppus air filters.

GUSTIN - BACON Manufacturing Company of Kansas City, Missouri, recently has expanded its lines of manufactured products and its distribution and sales locations. During the first part of 1934 a branch and sales office was opened at Houston, Texas; early this year established sales representation at Wichita and just recently at Dallas, Texas. The company also operates service depots at Chase, Russell and Burrton, Kansas, and Oklahoma City, Oklahoma, and at Kilgore, Texas.

In the last year it has placed on the market several new products, notable among which are "G-B Rokflos" insulation and pipe covering; "G-B Rolagrip" pipe couplings and a complete



Kinney Heliquad Pump assembled ready for installation on Bay Towing Co. Barge No. 105. See story below.

18 months pumping without a minute of lost time

Refining oil has many pumping problems—and transporting it for sale has some too! As typical of the service Kinney Pumps render in any kind of oil pumping service we submit these reports:

BAY TOWING COMPANY—BARGE No. 105—20"x10" Kinney Heliquad Model A Pump. Rated Capacity 2,500 barrels an hour. This pump has actually averaged 3,000 barrels an hour pumping six hours per day every day for the past 18 months. Pump has never been repacked or shut down for any kind of repairs.

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Frankly we think these pumps—like thousands of other Kinney's in service for much longer periods in refineries and on ship board—have written their own advertisement. We can only add that we shall be glad to send you New Bulletin No. 11 describing the type of pump that gave this service. Write to—

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A. L. Gustin, Sr., president of Gustin-Bacon Manufacturing Company, is well known in the petroleum industry.

J. F. Stephens, general manager located at Kansas City, is in active charge of the company's oil industry division. He came to the company two years ago from Goodyear Tire & Rubber Company, where he was assistant manager of mechanical goods sales.

W. L. Rock and Charles Wheatley, both located at Kansas City, supervise respectively the company's insulation and pipe line equipment sales.

J. F. STEPHENS

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JOSEPH M. BANDISH has resigned as Mid-Western sales manager for Durametallic Corporation and is no longer connected with the Chicago office of that company. He has not yet announced his plans for the future.

H. F. OSWALD of Oliver United Filters, Inc., New York, Chicago and San Francisco, is making an extensive tour of the refineries of the Mid-Continent and Southwestern fields.

THE Medart Company, St. Louis, Mo., announces the appointment of Colossus Industries, Inc., Shreveport, as distributor for its line of transmission equipment in the Louisiana territory.

H. ROSS CAMPBELL is now vice president in charge of sales for J. P. Devine Manufacturing Company, Mount Vernon, Illinois, and will move his family from Tulsa to Mount Vernon early this fall. He has been identified during recent years with the manufacture of liquid and solid carbon dioxide from natural gas. His experience in the manufacture of natural gas-

H. ROSS CAMPBELL

oline dates almost from the beginning of the industry. He was formerly with Phillips Petroleum Company, and later with Skelly Oil Company, serving as district superintendent in Oklahoma and Texas.

LEONARD PRICE has been promoted to supervisor of mechanical rubber goods sales for the Pacific Coast Division of Thermoid Rubber Company, Trenton, N. J. His headquarters will remain in Los Angeles and his supervision of mechanical rubber goods sales to the oil industry will continue as in the past, but his duties will be greatly enlarged to take in industrial sales as well.

ALLEN M. PEAIRS

ALLEN M. PEAIRS, of Dallas, Texas, has joined The Ralph M. Parsons Company as sales representative for Parsons-designed and Parsons-built Dubbs cracking units in the southwest. His headquarters will be 815 Tower Petroleum Building, Dallas, and his territory will include Texas, Oklahoma, Arkansas, Louisiana, and New Mexico.

Peairs, who is a graduate of the Colorado School of Mines, was for two years sales engineer for Foster Wheeler Corporation, in New York and Dallas, and for the past five years has been carrying on a consulting-engineering business of his own. The Ralph M. Parsons Company was incorporated less than a year ago. It is now engaged in the construction of two refineries, one for Wilshire Oil Company at Los Angeles, and one for the Home Oil Refining Company at Great Falls, Montana. The Wilshire plant will have a daily crude capacity of 12,500 barrels a day and the home plant 1000 barrels.

Asphalt Demand Revives in 1934

REVIVED activity in highway construction, stimulated by allotments of federal funds, and a somewhat greater demand for roofing raised production both of petroleum asphalt and of native asphalt and bitumen from 1933 to 1934. Refinery production of asphalt increased 16 percent from 2,456,051 short tons in 1933 to 2,840,496 tons in 1934, according to figures compiled by the Bureau of Mines, Department of the Interior. Domestic demand increased 12 percent, from 2,296,046 tons in 1933 to 2,569,395 tons in 1934. Exports of petroleum asphalt, especially to northern and western Europe and to the Far East, increased from 204,032 short tons in 1933 to 223,906 tons in 1934. Imports of asphalt and bitumen, however, decreased from 21,706 short tons in 1933 to 15,679 tons in 1934. As a result of the greater increase in production than in demand, stocks of petroleum asphalt held at refineries were 23 percent larger at the end of 1934 than at the end of 1933.

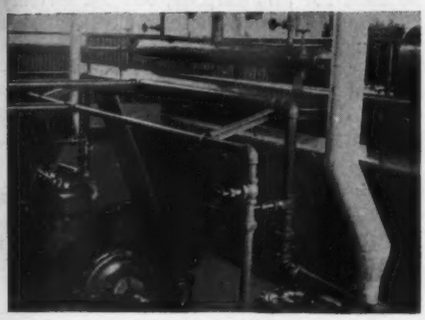
▼ IDEAS ▼

THE following items are typical of those desired by The Refiner for publication in this department. Where acceptable such items will be paid for at the rate of $5.00 each when accompanied by photograph or rough drawing for purposes of illustration, and $3.00 when not illustrated. The Refiner, since starting this department in February, has received valuable comment, suggestions and contributions, and it is apparent that readers place a certain value on this department, and therefore it is desirable that its publication be continued through the cooperative efforts of those in the industry.

Jacketed Exhaust Pipe In Engine Room

EXHAUST PIPES unless insulated cause considerable warmth in engine rooms where it is not particularly needed. To counteract the tendency of the engine room to become uncomfortably warm, the exhaust pipes of small gas engines, used to drive centrifugal pumps for water circulation, are jacketed by Union Oil Company, in the Santa Fe Spring gasoline plant.

A larger pipe was cut in sufficient lengths to surround the exhaust pipe of the small engines, forming a dead air jacket in the annular space within the jacket and outside the exhaust pipe. No circulation is obtained, but the heat is reduced. Sheet iron jackets would serve the purpose as well, it is said, and if they were open at the lower end, and the exhaust pipe placed in the jacket low enough that a jetting effect could be obtained, circulation of the air would be constant, as long as the engine was running.

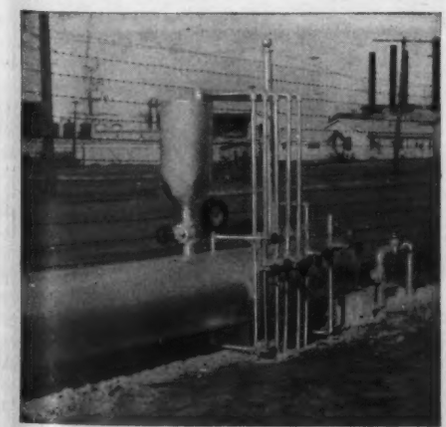


Jacketing Engine exhaust lines lowers temperature in hot engine rooms.

In winter in some climates where the temperature falls to a low figure, the heat from exhaust pipes is welcome, but in Southern California the temperature seldom drops to frost point, so jackets and other insulating apparatus are justified the year around. J. C. A.

Centralized Drip Handling System

WHERE condensate and distillate coming from drips must be skimmed before the water is disposed of, it is a problem at times to concentrate all of the fluid in one place without running a system of pipe lines all around the plant. This problem was met successfully in a plant operated by Industrial Fuel Supply Company at Dominguez, California. All of the drip connections were fitted with small transfer lines which were run to a common point at one side of the plant.



Industrial Fuel Supply Company, Dominguez, has centralized drip handling system.

A horizontal blow case was laid on the ground with a swedge nipple at the top into which all the liquid can be directed. The swedge is equipped with a gate between the bowl and the blowcase so that when the case is full, pressure may be applied to transfer the contents to a skimming tank.

The plant operator can blow all plant drips from one point, by simply opening the required valve on the line leading from the point where the condensate has accumulated. It is a convenient way of handling drips, whether the liquid must be handled afterward or not.

—J. C. A.

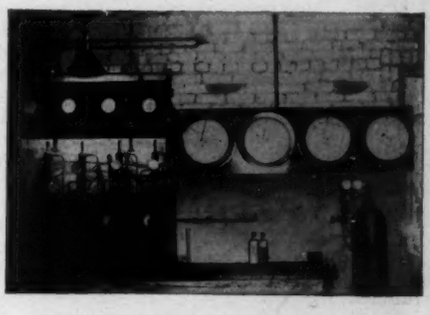
"Whistling Gate"

LOS NIETOS Producing & Refining Company's Kettleman Hills, California, plant is surrounded by the usual type of wire fencing, and for the usual reasons. Only one gate is provided for entering and leaving the plant yard, and the company rule requires that anyone entering the plant notify the man on duty at the nearby boiler house. To secure his attention, as well as to announce that some one is entering the yard, a device has been installed which converts the entrance way into a "whistling gate."

The make-up and operation of this alarm is simple. It consists of a small whistle of the type ordinarily used to indicate high and low water level in the boilers. The whistle is placed on the nearest steam line leading from the boiler battery, and is operated by means of a cord attached to the operating lever and to an arm fastened to the gate. When anyone enters the gate the whistle is automatically operated when the gate is opened. To prevent undue strain on the cord and the whistle lever, a coil spring is attached to one end of the cord; this keeps it at a tension and at the same time prevents too much strain when the gate is fully opened. J. C. A.

Oxygen Bomb Testing Set

THE usual form of potential gum testing apparatus consisting of a metallic bomb enclosed in a steam jacket with a recording pressure gauge connected to the bomb. This system is followed as shown in the photograph, but the testing bench consists of four bombs, and therefore four recording pressure gauges. This makes possible the determination of gum on many more samples per day than is possible with less units. The use of recording pressure gauges enables the laboratory operative to engage in other work while this test is underway. In this battery of bombs a work table giving about four feet working space is provided beside the bomb cabinet and the table is provided with three drawers for storage of small tools, charts, and other devices required for carrying on the work. The pressure gauges are located at convenient height for reading and for removal of the charts. The oxygen drum is placed in convenient location for manipulation of the fittings and removal of the empty drum. The case housing the four bombs is made of plate steel for safety. The door rises upwards, as shown in the photograph, when necessary to work with the bombs, and is closed during testing. Holes are provided in the front side of the steel case both for ventilation and inspection purposes.



Battery of bombs for gum testing.

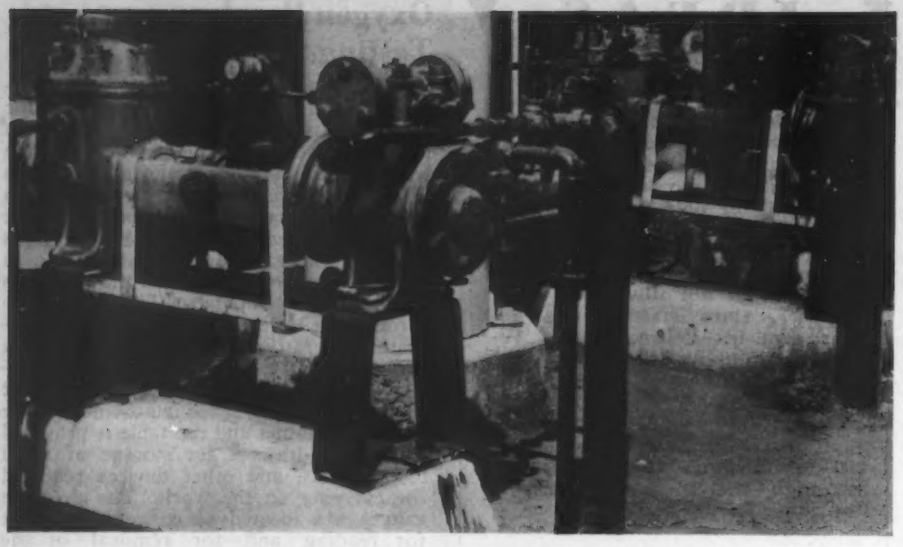
E. R. JONES,
Skelly Oil Company.

Drip Pans Under Steam Pumps

OILERS and other employees who have been detailed to keep equipment clean, originate a lot of ideas about how it is accomplished. At the O. C. Fields Gasoline Corporation plant, Huntington Beach, California, some one developed a method by which he could prevent excess oil from dripping from rocker arms and cross shafts on pumps in the plant.

He took sheet metal of size large enough that each piece could be crimped and formed to make a pan to slip under the pumps. Going one step further, he took heavy straps of galvanized iron made in the form of hangers, which when bent at each end could be slipped on the spacer castings between the power and fluid ends of the pump. They are long enough and wide enough that both packing glands are covered as well as the cross shafts. To keep from removing the drips as they collected, he placed drain lines in each pan which leads to the common drain system in the plant.

The cost of these drip pans can



Drip Pan under pumps help keep the place clean and safe.

hardly be estimated, for some operators might want elaborate welded or soldered ones, while others can get the same thing by bending the sheets on edges of boards, or have them made complete at a tin shop. Soldered spouts can be made on the pans which may be slipped into the drains when replacing the pans after they have been removed for cleaning. The use of these pans keeps the place looking neat and prevents an accumulation of lubricating oil. J. C. A.

Copper Sulphate Mixing Drum

ALGAE in the cooling water represents another of the troublesome pests often besetting the plant operator. Mixing copper sulphite with the water is not a difficult matter, but it is often improperly and wastefully done. At the Bell plant, Santa Fe Springs, California, Union Oil Company has a mixing drum that eliminates both trouble and waste.

A make-up connection which operates automatically is located outside of the cooling tower basin, and water is almost constantly being fed from the water supply lines to the basin. At this point is a small pot made of a piece of 10-inch pipe. It is closed at the lower end and provided with a one-inch overflow line which is welded into the side and near the top. A half-inch line is tapped into the water supply system behind the control gate and leads to the chemical drum. A gate valve in the half-inch line serves to regulate the amount of water flowing into the small drum.

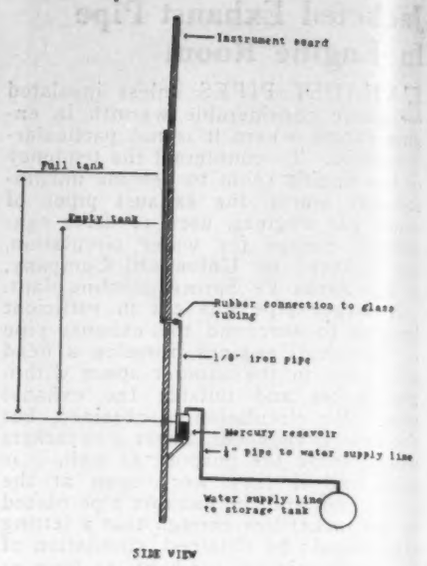
The outlet end of the half-inch line extends down into the pot so that the water must flow upwards through the chemical before entering the cooling tower basin. The drum is filled with copper sulphate as often as needed and the half-inch line opened so the water can dissolve the chemical and carry it to the circulating water entering the basin. When algae is present, a pound or two of chemical is placed in the pot—and the job forgotten. And, no chemical lays on the bottom of the cooling tower basin undissolved. J. C. A.

Remote Gauging of Elevated Tanks

A SIMPLE and convenient instrument panel device for the remote gauging of elevated water tanks, circulating towers or storage reservoirs may be made by connecting a mercury manometer in series with the water supply line. The difference in the pressure exerted by the height of the water column between full and empty levels actuates the mercury in the manometer causing a corresponding rise and fall in its height.

For example: A 15-foot water storage tank sets on a hillside some distance away and 35 feet above the plant level. When the tank is empty the 35-foot column of water in the supply line exerts sufficient pressure to raise a column of mercury 31 inches. When full, the total head of 50 feet of water will raise the column of mercury 44.25 inches, or a difference of 13.25 inches in the height of the column between full and empty tank levels. This difference can be conveniently pointed off in appropriate notations, ¼ full, ½ full, etc., or it may be easily converted to feet and inches of water.

The ordinary mercury manometer may



SIDE VIEW

be used for this purpose, but the mercury column illustrated here makes a much neater installation. When installed upon the instrument panel against a black background the shining column of silvery metal shows up nicely and makes a neat and very useful addition to any board.

RUSSELL M. LILLY.

Reading Gravity At the Pump

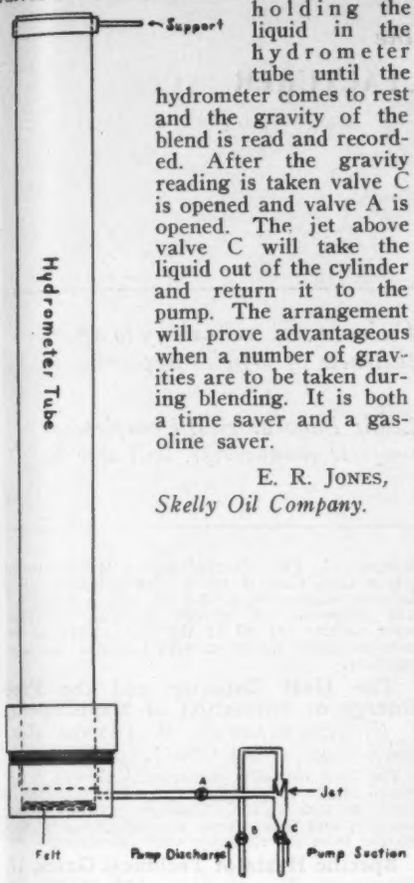
FREQUENT drawing of samples of gasoline at blending pumps, accompanied by the inevitable waste of gasoline, the possibility of accumulation of vapors in the pump house, and some "spillage" can be eliminated by the installation of a simple device such as is shown in the drawing.

In this apparatus a hydrometer tube is attached to gasoline blending pumps. The apparatus consists of a glass tube set in a metal block and made liquid tight by means of a packing gland. A piece of felt is placed in the bottom of the block to prevent breaking of the hydrometer, which is placed in the hydrometer tube.

Home made chemical mixing drum eliminates waste and saves time.

The tube is filled with the gasoline or blend by closing valve C and opening valves A and B. Valve A is then closed, holding the liquid in the hydrometer tube until the hydrometer comes to rest and the gravity of the blend is read and recorded. After the gravity reading is taken valve C is opened and valve A is opened. The jet above valve C will take the liquid out of the cylinder and return it to the pump. The arrangement will prove advantageous when a number of gravities are to be taken during blending. It is both a time saver and a gasoline saver.

E. R. JONES,
Skelly Oil Company.



Efficient Power Transmission

AN efficient means of power transmission to an assortment of machines has been worked out for one concern. Power is transmitted through a main shaft which is cut close to its center in three places and equipped with friction clutches at each cut. The cuts are four feet apart. Call the couplings 1, 2, and 3. Two electric motors drive the shaft. Motor A is twice the capacity of motor B and is connected through multi-V-belts between couplings 1 and 2 to a clutch-equipped sheave. Motor B is also connected between couplings 2 and 3.

When all machines are operated both motors are used, all friction clutches being "thrown in". When a few machines are needed, the shafts are connected and disconnected in the manner most suitable. Unused machines, operated through countershafts, are disconnected. Here, operation at high efficiency is possible nearly all the time, there being three different combinations: Motor B alone when minimum power is required; motor A alone for twice as much power; and both A and B when three times as much power is needed. If one section of the shaft is needed, either motor can drive either end.

W. F. SCHAPHORST,
Newark, N. J.

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SCIENCE AND TECHNOLOGY

Abstracts prepared in co-operation with the

REFINER AND NATURAL GASOLINE MANUFACTURER

by

THE LESLIE LABORATORIES

Traver Road, Ann Arbor, Mich.

under the supervision of

DR. E. H. LESLIE and DR. H. B. COATS

The abstracts here presented are selected from the current literature of science and technology to afford reference to fundamental information not easily available to all readers. Abstracts of articles appearing in readily obtainable trade journals are not included.

Photostat copies of original articles will be supplied at cost by the Leslie Laboratories. Complete or limited bibliographies covering special topics by tile, by abstract, or in complete manuscript, will also be prepared and furnished at reasonable cost by the Laboratories.

Chemical Composition and Reactions

Isolation of a Nonanaphthene from an Oklahoma Petroleum. J. D. WHITE AND F. W. ROSE, JR. *Bur. Stand. J. Research*, 13 (1934), pp. 799-810.

A nonanaphthene of 136.65°C. boiling point was isolated from Oklahoma crude oil. The petroleum was systematically distilled and the aromatic hydrocarbons removed from the fraction under consideration by means of liquid sulphur dioxide and fuming sulphuric acid. The naphthene was then isolated by fractional crystallization, starting from a solution in propane and methane, and then from a solution in dichlorodifluoromethane. Empirical formula C_9H_{18} was established and the substance was considered to be derivative of cyclopentane. The crude contains not more than 0.1%.

The Thermal Decomposition of Hexane at High Pressures. J. N. PEARCE AND J. W. NEWSOME. *Proc. Iowa Acad. Sci.* 41 (1934), pp. 139-40.

The thermal decomposition of hexane was studied at pressures between 14,000 and 15,000 pounds and at temperatures between 430° and 520°C. The time of heating varied from a few minutes to two hours. The percentages of methane, ethane, propane, and butane in the gaseous products are constant at 10°C. intervals between 460° and 490°C. and are respectively 25, 47, 15 and 7 percent. At 460°C. the respective proportions of hydrogen, ethylene, propylene, and butene in the gaseous products were 2.1, 1.4, 1.5 and 2.1 percent. As temperature increases, these decrease. At 497°C. hydrogen and acetylene have disappeared and the percentages of propane, butane, propene, and butene have dropped to 5.5, 4.0, 0.04, and 0.16 percent respectively. At this temperature, also, carbon forms rapidly and the proportion of methane noticeably increases and continues to increase with further rise in temperature. Also, the proportion of ethane rises sharply at this point and then drops back to its original practically constant value. On account of the small quantity of products produced it was not possible to make an accurate quantitative analysis of the liquid products. However, micro-distillation and qualitative tests showed the presence of cycloparaffins, benzene, substituted benzenes, and unsaturated higher hydrocarbons.

The Relation Between the Structure of Hydrocarbons and their Miscibility with Selective Solvents. S. P. MULLIKEN AND R. L. WAKEMAN. *Rec. trav. chim.* 54 (1935), pp. 366-72.

The miscibility of a large number of aliphatic and aromatic hydrocarbons with $MeNO_2$ was determined in order to formulate general rules for the identification of hydrocarbons by this procedure. Alkanes, cycloalkanes, dicycloalkanes, alkenes (usually), cycloalkenes, and alkadienes containing eight or more carbon atoms were immiscible with $MeNO_2$ at 20°. Aromatic hydrocarbons were more soluble. Unsaturated hydrocarbons in acyclic compounds can be determined by means of their miscibility in $PhNH_2$. Alkenes are immiscible. Alkines and alkadienes are miscible. Cyclic alkanes are ordinarily soluble in $PhCH_2OH$ at 50°, whereas the acyclic hydrocarbons are not soluble.

Water-White Hydrocarbons from Asphalt. HALLEY T. GAETZ. *Ind. Eng. Chem.* 27 (1935), pp. 647.

Fractions were separated from Trinidad asphalt that had remained water-white for more than two years. A separation into petrolene and asphaltene fractions was effected by fine-grinding and solution in petroleum ether. The solution was filtered through fuller's earth to remove resinous materials. The petrolene hydrocarbons were recovered from the solution by vacuum evaporation of the solvent. A dark green extract was distilled under high vacuum into three fractions and a residue. Each fraction was treated with 98 percent sulfuric acid, followed by water washing, drying with metallic sodium, and distilling.

Fundamental Physical Data

Phase Equilibria in Hydrocarbon Systems. VIII. Methane-Crystal Oil System. B. H. SAGE, H. S. BACKUS, AND W. N. LACEY. *Ind. Eng. Chem.* 27 (1935) pp. 686-90.

For comparison with previous studies the equilibrium relationships of pressure, volume, and temperature were studied for a system comprising methane and crystal oil. The temperature range investigated was from 70° to 220°F. and pressure was varied from the vapor pressure of crystal oil to 3000 pounds per square inch absolute. The composition varied from that of mixtures containing over 50 percent by weight of methane to pure crystal oil. Measurements were made of the total volume of the system of a known mass as a function of pressure, temperature, and composition. The crystal oil used was refined from a western, nonwaxy, asphalt crude oil. Its molecular weight was between 335 and 340. The methane was separated from natural gas by a liquefaction, followed by vaporization into activated charcoal at 50°F. and 400 pounds per square inch absolute pressure. Traces of ethane and higher hydrocarbons were reduced to less than 0.02 percent and less than 0.2 percent of nitrogen and similar gases. The data are accurate to the limit of one pound pressure, 0.2°F., 0.1 percent volume, and 0.1 percent mass. Break points in the isotherms indicate the disappearance of the gas phase on increasing pressure or its appearance on decreasing pressure. This point is termed the "Bubble Point." Representative experimental curves are shown as a whole and enlarged near the bubble point. Bubble-point pressure is shown as a function of composition. A complete tabulation of the specific volumes of the mixtures, showing volumes for different temperatures, pressures, and compositions, is given.

Pressure-Volume-Temperature Relations for Six Oils. R. B. DOW. *J. Wash. Acad. Sci.* 24 (1934), pp. 516-26.

The pressure-volume-temperature relationship for six oils at temperatures of 25°, 40°, and 75°C. and at pressures up to the hydrostatic pressures that cause apparent solidification were determined. The oils used were a Mid-Continent oil, a Gulf Coastal oil, a Pennsylvania oil, a Renown engine oil, a lard oil, and a sperm oil. The volumes and derived thermal properties were similar for all of the oils. Thermal expansion varies the most with pressure and temperature.

The Heat Capacity and the Free Energy of Formation of Naphthalene. J. N. PEARCE AND W. B. TANNER. *Proc Iowa Acad. Sci.* 41 (1934), pp. 123-26.

The heat capacity of naphthalene was determined in the temperature range between that of liquid air and 298.1°K. Changes in heat content, entropy, and free energy accompanying its formation from the elements were calculated.

Specific Heats of Technical Gases. H. BRUCKNER. *Z. anal. Chem.* 100 (1935), pp. 281-84.

Data are given on the specific heats of hydrogen, nitrogen, carbon monoxide, nitrous oxide, oxygen, chlorin, water, carbon dioxide, and air for various temperatures at constant pressure. The temperature range covered is from 20° to 3000° C.

Manufacture: Processes and Plant

Diffusional Processes. W. G. WHITMAN. *Jour. Soc. Chem. Ind.* 54 (1935), pp. 175 T-78 T.

The transfer of material and the transfer of heat from one phase to another are the most universal engineering problems encountered in the processing industries. The author outlines in a qualitative way the nature of the exchange between phases and emphasizes the wide applicability of a comparatively simple concept to a variety of problems that are nominally dissimilar. The rate at which a process can be effective has important economic significance, since it affects equipment and operating expense. All processes are to be interpreted in terms of "eddy diffusion" and "laminar diffusion." The former indicates transfer of material up to the true surface film, as by turbulent mixing. The latter is the movement of material through the film itself. The recognition of eddy diffusion as a significant factor has greatly clarified the correlation of diffusion phenomena with heat transfer and fluid friction phenomena. Applications of the conception to gas-liquid systems, as in gas absorption, humidification, and dehumidification, to liquid-liquid systems, as in the solvent-refining of lubricating oils, to gas-solid systems, as in combustion, and to liquid-solid systems, as in dissolving and leaching operations and metallurgical operations, such as open-hearth steel making, are reviewed and briefly discussed.

The Course of Liquor Flow in Packed Towers. T. BAKER, T. H. CHILTON AND H. C. VERNON. *Trans. Am. Inst. Chem. Engrs.* May, 1935 (preprint), 18 pp.

In packed towers of sufficient size the tendency for the liquid flowing downwardly to concentrate near the walls is absent, although this is marked in small towers packed with relatively coarse material. Uniform distribution of liquid, once attained, persists throughout any

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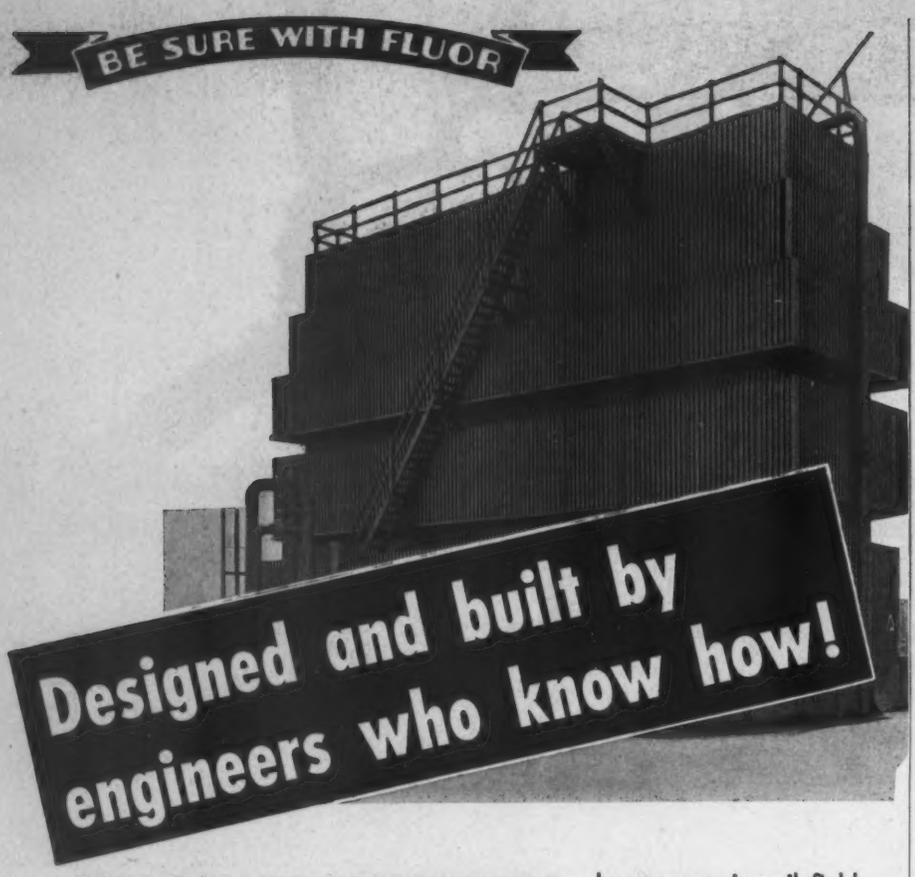

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Studies in a Continuous Rectification Column. H. U. KOHRT. *Forsch. Gebiete Ingenieurw.*, **4B** (1933), pp. 286-95.

The heat content-concentration diagram gives a better picture of fractionation processes than other procedures. The heat requirements can be determined by a simple approximate formula. Determinations of plate efficiency are difficult because of variation in equilibrium data. At vapor velocities between 0.1-0.47 m. per second plate efficiencies of approximately 60 percent were obtained when Bergstrom equilibrium values were used.

Materials on the Mechanism of the Vapor Phase Cracking Process. A. F. DOBRYANSKII, E. K. KANEP AND S. V. KATZMAN. Materials on Cracking and Chem. Treatment of Products Obtained. *Khimteoret (Leningrad), No. 2* (1935), pp. 60-71.

The yield of aromatics depends upon the amount of tars obtained in cracking, the maximum yields of C_6H_6 and $C_6H_5CH_3$ being observed at a tar yield of 40%, independently of the temperature of the vapor phase cracking process. A more severe cracking leads to the "burning" of fatty hydrocarbons and to condensation into cyclic thermally more stable systems of various products of the pyrolysis. The content of unsaturated hydrocarbons in the light oil decreases steadily with the deepening of the cracking reaction and it is well known that C_3 and C_4 compounds contained in cracked gases are easily polymerized to C_6H_6. Both facts lead to an increase in the percentage of C_6H_6 and $C_6H_5CH_3$. C_6H_6 is stable at 650-700°C. but in the presence of unsaturates the latter condense at the above temperature with C_6H_6 and this condensation is particularly effective if the C_6H_6 vapors are not diluted with other hydrocarbons. Therefore, the condensation processes are very vigorous at elevated temperatures when the light tar fractions are composed almost exclusively of C_6H_6. A light vapor phase cracking causes the appearance of $C_6H_5CH_3$ and only small amounts of C_6H_6, the ratio of the latter increasing with the increase in the cracking temperature, whereby the methyl group of $C_6H_5CH_3$ is split off and C_6H_6 is thus obtained. Thus the increase in the concentration of C_6H_6 with the increase of the cracking temperature proceeds much more rapidly than that of $C_6H_5CH_3$. The aromatics are formed from C_3H_6, C_4H_8 and bivinyl which are absent in gases obtained in high temperature cracking, and which under these conditions are not found in the cracked gas. Thus, at 550-650° C. the side chains are split open from C_6H_6 homologs and C_6H_6 is obtained, the hydrogenation reaction setting in at 600-700°C. and only above that temperature the condensation of fragments takes place. These reactions can be effected in the cracking of light distillates such as gasoline, naphtha and kerosene, while paraffins and heavy distillates such as gas oil are unsuitable. The formation of aromatics from naphthenes can probably be traced only in cracking under pressure, since the latter are easily destroyed under conditions of a very superficial aromatization by means of vapor phase cracking. Bivinyl is probably the first product formed in cracking, although it is rapidly decomposed when exposed to cracking conditions, its raw material being naphthene and polymethylene hydrocarbons. A cracking temperature in excess of 600°C. is too high for the production of commercial gasolines because of the excessive formation of gases, which should not exceed a total of 15-20%. These conclusions were made on the basis of a series of experiments (by various authors) to be reported in the succeeding papers. The apparatus used in the pyrolysis has one iron or porcelain reaction tube (100 centimeter long), with an inner diameter of 34 mm., two upright Liebig condensers arranged in series (each 100 c. long) and two flushing towers of the same length. The condensate was cooled in the usual manner and the reflux was not recycled but analyzed immediately after the withdrawal from the system. The gases were collected and analyzed.

Abs. from For. Pet. Tech. 3 (1935), pp. 269-71.

The Catalytic Action of Coke in the High Temperature Cracking. N. A. BUTKOV AND E. YA. OSTROVAI. *Neftyanoe Khozyaistvo* **27** (1935), No. 2, pp. 75-6.

The high temperature cracking consists of two phases, the primary dissociation and the con-

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densation of the products of dissociation. The former is almost independent from the coke, i.e., these reactions are classified as homogeneous. The process of condensation, which usually occurs in the second part of the retort, depends on the amount of coke in the retort and is accordingly a heterogeneous catalytic reaction with coke playing the part of a catalyst. Consequently, a small amount of coke in the retort promotes higher yields of aromatics. Great amounts of coke cause a heavy condensation which is accompanied by a lower yield of aromatics, gas and light oils. Heavy cracking carried out in a retort free of coke gives a low yield of aromatics and a high yield of gas. The operating conditions are ascertained best by the content of unsaturated hydrocarbons in the gas. The yield of coke depends upon the contamination of the stock and it may amount to 1.2 to 6.9%.

Abs. from For. Pet. Tech. 3 (1935), pp. 268-69.

Problem in Connection with the Change in Velocity of the Cracking Reaction with the Temperature. S. N. OBRYADCHIKOV. *Neftyanoe Khozyaistvo* 26 (1934), No. 12, pp. 35-7.

After giving a critical review of equations, giving the relationship between increase in the cracking velocity and the temperature increase proposed by a number of authors, O. states that the energy of activation of cracked naphtha is lower than that of straight run naphtha, whilst it is reversed for heavier fractions. Thus the energy of activation of cracking is higher for light products and lower for the heavy ones. The aromatized fractions will have a higher energy of activation at the same molecular weight than paraffin hydrocarbons. The temperature coefficients of the cracking velocity are lower for lighter fractions, requiring a lower increase of temperature to double the yield of cracked products than would be the case with heavier fractions. Thus, if reforming of gasolines requires 70,000 cal.g.mol., then at 400°C. the reaction velocity will be doubled at a 9°C. and at 500°C. at a 12°C. raise of the temperature.

Abs. from For. Pet. Tech. 3 (1935), p. 267.

Laboratory Cracking Data as a Basis for Plant Design. R. L. HUNTINGTON AND G. G. BROWN. *Ind. Eng. Chem.* 27 (1935), pp. 699-707.

An apparatus is described for the making of laboratory cracking experiments. The material cracked was a combined feed from a commercial cracking plant. This feed contained approximately 75 percent of recycled material. Yields of gas, gasoline, coke, and polymers were determined, as well as specific volumes of the system, both as functions of time, temperature, and pressure. Rates of reaction were computed and were found to be in agreement with those of previous investigators. The specific volume data were used in comparing the reaction rate found in the laboratory with plant operation. The data are presented in tabular and graphical form. A bibliography of 19 references is appended.

High-Pressure Plant for Experimental Hydrogenation Processes. A. T. BARBER AND A. H. TAYLOR. *Engineering* 138 (1934), pp. 576-78, 635-36.

Catalysts were tested in 120 cu. in. autoclaves, heated by gas or electricity. A charge of hydrogen up to 1500 pounds per square inch was added to the autoclave containing the coal or coal tar to be hydrogenated. During the reaction the maximum pressure ranged from 2800 to 4500 pounds per square inch. Several two-liter batch converters were used, as well as a small reaction chamber for coal, equipped with a mechanical stirrer. A tar converter was four inches in diameter, 20 inches long, with 1.25 inch walls. The time of individual runs varied from a few hours to a week. Larger scale plants were constructed to operate, using 300 gallons daily at 3000-6000 pounds pressure.

Refining Automobile Fuel by Means of Hydrogenation. Stabilization of Vapor Phase Cracked Gasoline. B. L. MOLDAVSKII, V. N. POKORSKII AND I. L. ANDREEVSKII. Translated from Russian by A. A. Boehtlingk in *Foreign Pet. Tech.* 3 (1935), pp. 215-40.

A method for the preparation of stable vapor-phase cracked gasoline by means of hydrogenation has been developed. The pressures used are 10 to 40 atmospheres, temperature 320° to 400°C., volume concentration of hydrogen up to 3.5 percent of the product, time of contact 0.1-0.5 minutes, and hydrogen consumption 0.5-1.0 percent by weight of the raw material. No loss is had when hydrogenation is used to refine the product. Suitable hydrogenation catalyst

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has been found, which is sufficiently stable from a practical standpoint, is easily regenerated, and has satisfactory mechanical strength. The hydrogen can be reused until so dilute that it is not economical to reuse it. The authors believe that the investigation has demonstrated that the process is commercially usable. They state that this method of refining gasoline solves the problem of quality in the production of cracked gasoline and changes the problems in connection with losses. The checking of the process on a commercial scale and its rapid adoption by the industry is regarded as one of the most important problems of the industry in Russia.

The Activation of Raw Bleaching Earths. U. HOFMANN AND K. ENDELL. *Angewandte Chemie,* **48**, Mar. 23 (1935), p. 187.

Fifty-four bleaching and fuller's earths were subjected to X-ray examination and to tests of bleaching action, using soya-bean oil. All but three of the earths were essentially clay minerals of the montmorillonite type, with impurities, such as quartz, present. The investigation led to the conclusion that activated bleaching earths contain as exchangeable ions mainly hydrogen and aluminum with smaller amounts of calcium and magnesium. In raw earths calcium and magnesium ions predominate and hydrogen and aluminum are present in small quantities. The action of strong acids or electrodialysis replaces calcium and magnesium ions with hydrogen and aluminum and, as these ions are replaced, bleaching action of the earths increases regularly. The problem of the activation of bleaching earths is not yet explained in all particulars. The favorable action of raw earths in some cases, and also the de-acidifying action of highly activated bleaching earths upon acid mineral oils, is as yet unexplained.

Superheating and Foaming Phenomena in Dehydrating Emulsified Oils. G. EGLOFF AND S. BERKMAN. *J. Phys. Chem.* **39** (1935), pp. 265-75.

The dehydration of emulsified crude oil is accompanied by priming and foaming as a result of superheating of water contained in the oil. Foaming of emulsified oils depends on the nature of the oil and is not additive when oils are mixed. The depth of the foam column depends upon the depth of the oil.

The Utility of Lanolin as a Protective Measure Against Mineral Oil and Tar Dermatitis and Cancer. C. C. TWORT AND J. M. TWORT. *J. Hyg.* **35** (1935), pp. 130-49.

The best protection against dermatitis and cancer caused by mineral oil or tar is given by a mixture composed of equal parts of lanolin and olive oil.

Corrosion, Causes and Prevention. F. N. SPELLER. *Book. Published by McGraw-Hill Book Co., New York.* 694 pp. $7.00.

The first edition of this standard work on the subject of corrosion appeared some 10 years ago and since that time many experimental data have become available. The general form of treatment and the classification of factors and types of corrosion that were used in the first edition have been retained. However, since the electrochemical theory of corrosion in the presence of water has been generally accepted, the mechanism of corrosion has been treated on this basis. Important revisions have been made in chapters dealing with factors internal and external to metals, and with methods of testing. New knowledge on the subject of soil corrosion and protective coatings for use underground has been added. The book in its present form is undoubtedly one of the most inclusive and authoritative on the subject.

Products: Properties and Utilization

Propane and Butane as Industrial Fuels. E. A. JAMISON AND W. H. BATEMAN. *Iron Steel Engr.* **12** (1935), *pp.* 209-14; cf. C. A. **28**, 6973[8].

A tabulation showing the usual properties of liquefied petroleum gas products is given. The ratio of production to consumption of these hydrocarbons is now about 25:1. The advantages of the liquefied petroleum gases as against fuel oil are: (1) no pumping is required, (2) no steaming of tank cars for unloading, (3) no sediment or sludge that is a waste, (4) sulphur fumes are eliminated, (5) grease and dirt is minimized, (6) smoke and soot are not formed when furnaces are started, (7) maintenance of furnace refractories and alloy parts is minimized, (8) no sulfurization of alloy furnace parts, (9) furnace control is improved, both as to temperature and nature of atmosphere, and (10) scaling of product is reduced.

High-Pressure Lubrication for Journal Bearings. G. WELTER. *Engineering,* **139** (1935), p. 274.

The author describes experiments in which journal bearings were lubricated with oil at extremely high pressures. An effort was made to overcome the large frictional loss and resulting wear in starting machinery with journal bearings. Extra oil at pressures of 100-200 atmospheres was supplied at the top of the bearing, thus essentially lifting the bearing with its load off the shaft. Curves are given that show the variation of dynamometer readings with time when using normal or pad lubrication and the high pressure lubricating methods. The latter results in a striking improvement, whether starting at room temperature or at low temperatures.

Extreme Pressure Lubricants. E. H. KADMER. *Oel w. Kohle,* **11** (1935), pp. 116-118.

The author gives a comprehensive review of the Journal and Patent literature on the subject of extreme pressure lubricants. Theoretical principles are discussed and this is followed by detailed consideration of the various substances and their effectiveness. Metallic soaps, for example, zinc, aluminum, and lead, are more effective than the alkali oil-soluble soaps, both in raising viscosity and viscosity index, but they possess no surface activity. Sulphur is considered to act through the formation of the highly resistant film of sulphide, and this film is stronger when sulphur is present in the free state. Colloidal graphite is recognized as an active and valuable agent for dealing with high pressures as developed in new engines.

Lubrication. A. E. DAWKINS. *Australian Chem. Inst. J. and Proc.* **2** (1935), pp. 41-50.

The coefficients for three stages of lubrication are given as follows: dry lubrication, 0.10-0.40; viscous lubrication with full fluid-film formation, 0.001-0.01; boundary lubrication with greasy or partial metal contact, 0.01-0.10. Close correlation between laboratory measurements and math-

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ematical calculations is discussed. Oiliness, however, plays a large part in boundary lubrication. Measurements of coefficients of friction reveal the superiority of vegetable or fatty oils over the mineral oils. The coefficient of friction is not related to the viscosity of oils. Castor, lard and rapeseed oils show a constant coefficient up to 80°C., although mineral oils show a sudden drop at lower temperatures, called the critical temperatures. The coefficient of friction varies both with the oil and with the metal. Hence, oiliness is a function both of the oil and of the metal surface itself. The gumming of the fatty oils can be minimized by dilution with a mineral oil, without impairing oiliness and a further benefit is had by the use of a small amount of fatty acid in the oil. In choosing a lubricant both viscosity and oiliness must be considered. In viscous or full fluid-film lubrication, viscosity controls, but in boundary lubrication, oiliness is most important.

Cutting Oils and Cutting Lubricants. R. N. SMITH. *Can. Chem. Met.* **19** (1935), pp. 70-1.

The author discusses the physical properties and chemical compositions of cutting oils and similar emulsions. Limitations in uses and of the possible dilutions of soluble oil and of cutting paste are given.

Nitric Acid in Used Motor Oils. C. EHLERS. *Petroleum,* **31** (1935), No. 15; *Motorenbetr.,* **8**, 2-3.

While determining water in used lubricating oils by the use of xylene, brown vapors were observed and nitric acid was identified in the aqueous distillate. Both nitric acid and also NO-compounds that readily decompose were present. Both of these concentrate in the sludge and residues in the crankcase and oil lines. Used oils from Diesel engines were likewise found to contain nitrogen compounds and nitric acids.

Corrosion of Bearing Surfaces. C. H. BIERBAUM. *Mech. Engineering,* **57**, April (1935), p. 239.

The author discusses the oxidation of lubricating oils in relation to corrosion of bearing surfaces. Two conclusions are drawn. First, that a bearing will ultimately be destroyed by the corrosive action of oil unless oxidation can be entirely prevented, and second, that destructive laboratory bearing tests are futile. The corrosion of the bearing surface may be uniform or it may be selective. If only the softer crystals are attacked to a slight extent, the effect is beneficial because the film then contains more oil. If the attack is general, as it always is in the presence of sulphur and of many of the fatty acids, the result may be entirely destructive. However, slight general corrosion is beneficial if it does not interfere with the retention of the oil film. This contention is supported by the excellent condition of one of the crank bearings of a motor car that has run 105,000 miles under severe conditions. A high-grade Pennsylvania-base oil was used throughout and was neutral at first but after 1000 miles in use was distinctly acid. No sulphur was present. Micrographs showed that etching has been general but slight, and the limited corrosion had not prevented the oil film from being retained.

Lubrication and Corrosion. P. F. THOMPSON. *Australian Chem. Inst. J. and Proc.* **2** (1935), pp. 50-4.

In the lubrication of refrigeration machines it is desirable to prevent water from coming in contact with the metal surfaces where it can cause corrosion. To effect a perfect bond between the metal surfaces and the lubricating oil the surface tension must be lowered as by presence of polar groupings in the mineral oil. Lanolin is a valuable substance for such use, possibly because of the presence of unsaturated groups and also possibly because of its alcohol nature. Fatty acids, although they reduce the surface tension of mineral oil, are not applicable to this purpose because of their reaction with the gases used in refrigeration processes.

A Micro-Viscosimeter. F. M. LIDSTONE. *Jour. Soc. Chem. Ind.* **54** (1935), pp. 189 T-90 T.

A micro-viscosimeter for use when the supply of liquid under examination is very restricted is described. A viscosimeter of the Ostwald type is worthless, since the errors resulting from drainage and capillarity vitiate the results. Fine capillary tubes are to be avoided because of the risk of clogging with dirt. The apparatus described is really the simplest form of absolute viscosimeter. It comprises a capillary tube, uniform in bore, approximately 30 cm. or more in length and tapered at the lower end so that it can be immersed in a very small quantity of liquid. The liquid is sucked up into the tube and allowed to fall back under gravity, the time being taken for the passage of the meniscus between any two points. The radius of the capillary tube is 0.03888 cm.

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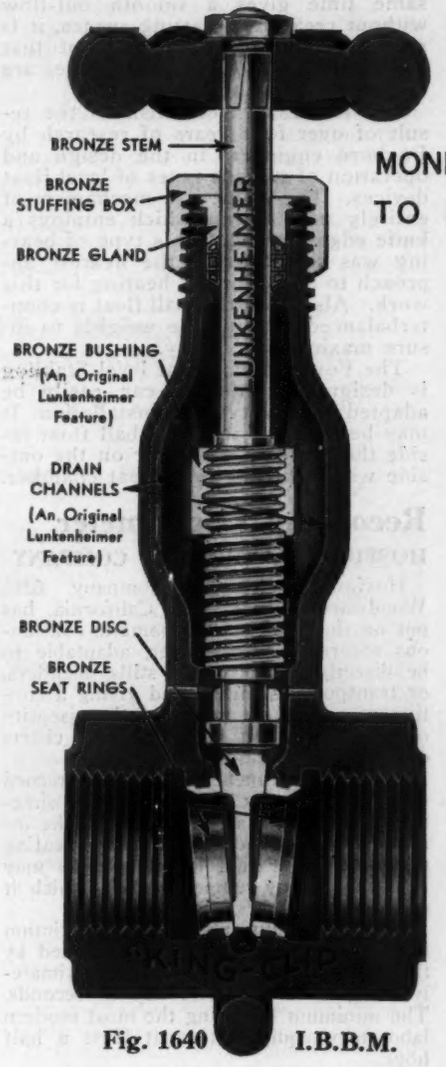

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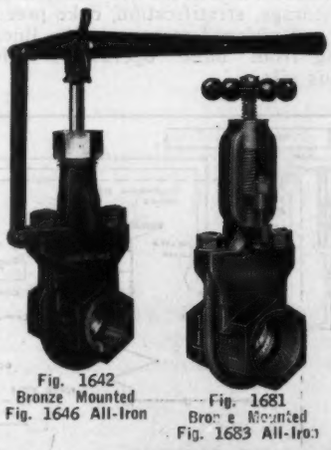

Fig. 1642 Bronze Mounted Fig. 1646 All-Iron

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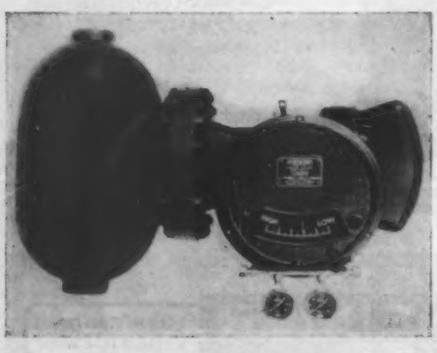
The Foxboro Company, Foxboro, Mass., announces development of a new type of liquid level control instrument. It is the Stabilog system of control added to specially designed friction-free ball float mechanism. This control instrument will maintain a level in a chamber within safe limits and at the same time gives a smooth out-flow without creating upsetting surges, it is said. Sudden increases in input that would ordinarily cause such surges are averaged out by the Stabilog.



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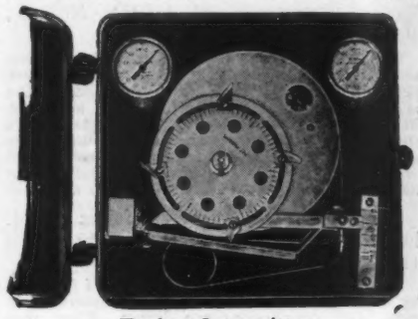
The Taylor Instrument Companies, Rochester, New York, has announced an intermitter, which was designed to control the flow cycle of gas lift systems. The intermitter can be adjusted to admit the repressuring medium into the well for the required length of time at specified intervals. The instrument also can be adapted to produce a series of quick "kicks" immediately before admitting the full pressure. If it becomes necessary at any time to alter the original repressuring schedule, it

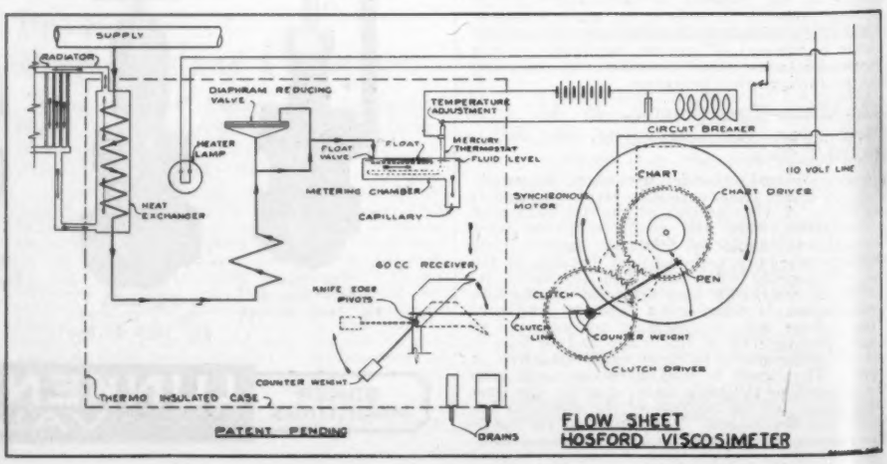


Taylor Intermitter

may be easily accomplished without replacing or cutting the cam.

Instead of employing the conventional "fixed" cam to time the intermittent operation of a diaphragm valve or other diaphragm-operated devices, the intermitter has a circular cam on which the proper number of actuating lugs may be placed, which is the number of lugs corresponding with the number of operations to be performed during the rotation of the cam. As many as 20 lugs may be used. The duration of each operation is adjustable by moving the bracket carrying the nozzle (upper left corner of case) so that its scribe mark is opposite the desired time interval on the scale. The higher the position of the nozzle, the shorter the period of nozzle closure and the duration of the operation.

The actuating cam is driven by a powerful spring-driven clock, available with one-hour, six-hour, 12-hour and 24-hour rotation. Electrically driven

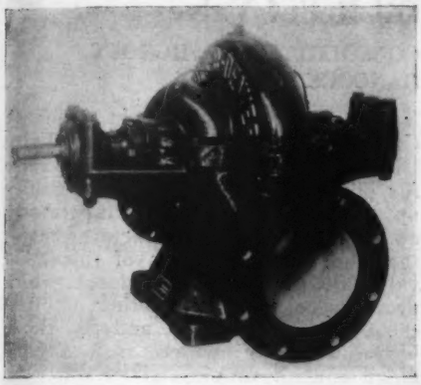


clocks with identical periods of rotation also can be supplied. The instrument is available in two types, the reverse-acting with lugs close nozzle, applying pressure to the diaphragm, and the direct-acting, with lugs open nozzle, relieving pressure from diaphragm motor. An overpressure release protects the diaphragm motor from excessive pressures in the event of reducive-valve failure. Compressed air or gas at a constant pressure of 25 pounds per square inch may be used.

Centrifugal Pump

GARDNER-DENVER COMPANY

Gardner-Denver Company, Quincy, Ill., has announced a new line of double-suction, single-stage, split case centrifugal pumps which the manufacturer claims combines a number of unusual features. The new line of pumps is adaptable to all



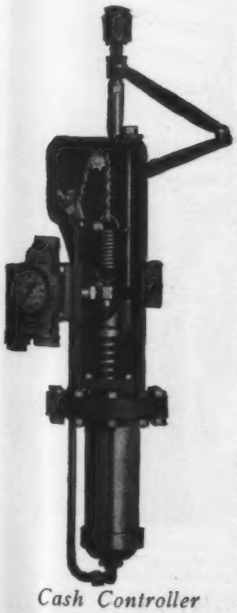
Gardner-Denver Centrifugal Pump

classes of service. All models are designed for any type of drive, including flat belt, V-belt, direct connected, gas or Diesel engine, and electric motor. The pumps cover heads up to 300 feet, but a wide variety of types are available.

Controllers

A. W. CASH COMPANY

A. W. Cash Company, Decatur, Illinois, announces Type 100 Series of Controllers each of which is a self contained unit comprising (1) an actuating member, diaphragm or lever, (2) a four-way control valve which governs the flow of water, oil, or air to (3) a double-acting power cylinder that is built nto the unit as an integral part of it, (4) a built-in compensator, and (5) a simple range adjustment.



Cash Controller

The pressure responsive (or actuating) member may be a diaphragm with the controlled pressure on one side, a diaphragm with the controlled pressures on both sides, or a lever which is moved by some outside or remote means. The purpose is to operate balanced valves, chronometer valves, butterfly valves, dampers, regardless of size; to operate electric rheostats, stokers, pulverizers, fans, and other apparatus driven by engines, turbines or electric motors. The objective is the automatic control of the factors of combustion; automatic fluid pressure control reduction, regulation, or relief; back pressure control; rate of flow control, or liquid level control.

They are said to be sensitive because of the steps taken to eliminate friction, i. e., frictionless diaphragm bearing, frictionless and leakless packing and four-way valve, and the suspension of the spring load in such a manner that side strains on the valve lever are eliminated. The compensator works so that a given percentage of change in the pressure under control will result in an equal percentage of change in the output of the apparatus under control.

Fire Extinguisher

WALTER KIDDE & COMPANY

Walter Kidde & Company, Bloomburg, N. J., announces a new hand fire extinguisher of the carbon dioxide type has recently been brought onto the market in the low price range. This extinguisher, known as LUX Model 2

Kidde Fire Extinguisher

is, in reality, the small brother of the larger LUX systems available for oil and electrical fires and employs the same instantaneous smothering method of fire extinguishment.

It is especially recommended for incipient fires in garages, trucks or isolated oil and electrical equipment. The extinguishing agent, carbon dioxide gas, is absolutely harmless to man or material but still is the fastest extinguishing agent known. The gas is good until used.

The model is of rugged construction throughout, weighing but 10¾ pounds and contains two pounds of gas. Operation is simplified by a seat type valve, which allows discharge to be turned on or off in the same manner as a water faucet.

Chain Hoist

THE YALE & TOWNE MFG. COMPANY

The Yale & Towne Manufacturing Company, Philadelphia, has announced a hoist and chain pull that has been named the "Pul-lift." The name is derived from the fact that the device may be used in either horizontal or vertical position. Used horizontally it may be employed in stretching cables, pulling in boiler tubes, pulling machines into position and for other purposes.

Diaphragm Valve

C. J. TAGLIABUE MFG. CO.

C. J. Tagliabue Manufacturing Company, Park and Nostrand Avenues, Brooklyn, N. Y., announce the Tag. long range throttling top, diaphragm valve. Particularly noteworthy, the manufacturer states, is the arrangement for adjusting spring pressure. The member in contact with the bottom of the spring

Tagliabue Diaphragm Valve

does not turn when the adjusting feed screw is turned but guided by the two vertical fins of the spider arms, merely moves up or down. Thus spring adjustment does not tend to wind up the spring or disturb its normal characteristics in any way.

Welding Torch

THE LINDE AIR PRODUCTS CO.

The Linde Air Products Company, 30 East 42nd street, New York, announces a new welding torch known as the Purox No. 35 General Duty Welding Torch. In mechanical details this new piece of equipment embodies refinements in design and operation that make it outstanding among medium pressure torches, it is claimed. Constructed of extruded brass, Monel metal, and drawn copper, and with silver soldered tubes, this torch is rugged and can stand rough treatment. Its range of usefulness makes it equally adaptable to the lightest as well as the heaviest work to be found in any welding shop. It is listed by Underwriters' Laboratories, Inc.

The ribbed design of the extruded brass handle reinforces the torch and enables it to be easily gripped. The connections are ferrule type and extend parallel to the axis of the handle. The individual mixers in each welding head are so designed that maximum resistance to flashback is afforded and at the same time the effective range of each size tip is greatly increased. Nine tips perform the duty of 15, the number usually required. The Monel metal seating surfaces are protected, wear-resistant, and easily removable for cleaning or replacement.

A hexagonal socket arrangement permits the welding head to be assembled in the most convenient of six optional positions in relation to the body. This arrangement also prevents injury or scoring of the seating surfaces.

The tips are of hard-drawn copper. They are of the right weight to withstand excessive heat and to maintain perfect balance in the torch as a whole.

55 Years of Dependable Service

K&M Products

Whether it be a valve or a liquid level controller, K & M Products will give dependable long service. Many of the largest industrial plants and refineries have proved this. May we quote on your requirements too?

VALVES: pressure regulating, air pilot operated, balanced, back pressure; LIQUID LEVEL CONTROLLERS; PUMP GOVERNORS; STEAM TRAPS.

KIELEY & MUELLER, Inc.
Main Office and Warehouse:
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Factory: Newark, N. J.

LICKING A TOUGH TOWER CLEANING JOB

This gas absorption tower of a certain west coast oil company was so glutted on the inside with an accumulation of gummy deposits that it just wouldn't function. The holes in the trays were plugged so that the heavy ends of the absorption oil ran out over the top of the tower.

By circulating a boiling solution of an Oakite material specially recommended for this work through the tower for 12 hours, alternating the direction of flow every 2 hours, the tower was cleaned and put into perfect condition.

Write for helpful data on all maintenance and operating equipment cleaning operations.

Manufactured only by
OAKITE PRODUCTS, INC.
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New York, N. Y.

Since 1909 the Standard of Cleaning Quality
OAKITE
Industrial Cleaning Materials and Methods

Gas Detector

FEDERAL INSTRUMENT CORP.

The Federal Instrument Corporation, 325-341 Classon Avenue, Brooklyn, New York, announces that installation has just been completed in the Jersey City Eagle Works of Standard Oil Company of New Jersey, or several MacCain automatic gas detector and signal units. The MacCain detector is so constructed as to provide continuous detection of the presence of hydrogen, carbon-monoxide, illuminating gas, the methane series of hydrocarbons and derivatives, and the vapors of some combustible liquids in air. The instrument responds to very small proportions of ether, acetone, naphtha, benzol, methyl-ethyl and propyl alcohols.

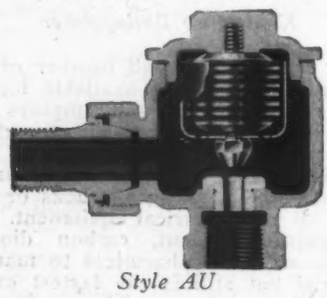
The detection and automatic indication of the presence of combustible gases in the air is a problem of vital importance in the refining industries, both for controlling certain processes and for safeguarding life and property.

Briefly stated, the MacCain type of automatic gas detector and signal device operates as follows: The instrument is placed in the desired position and the electrical lead is connected to its socket. When combustible and explosive gas reaches a percentage approaching the danger zone, the light and bell—a two-fold protection—operate automatically and continue their audible and visible warning signals as long as the dangerous condition prevails.. With the clearing away of the combustible explosive vapor to the allowable percentage, the automatic light and bell alarm cease to operate.

Steam Traps

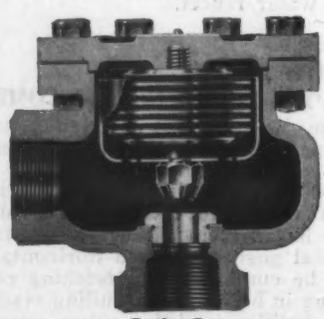
W. H. NICHOLSON & COMPANY

W. H. Nicholson & Company, Wilkes-Barre, Pa., announces two new models of steam traps called Style "AU" and Style "C." Style "AU," with



Style AU

a union connection and of bronze construction, is adaptable for use on radiators and unit heaters where reduced high pressure steam is used. In event the reducing valve should stick, or get out of adjustment, and the pressure increases up to as high as 150 pounds, it will not damage the bellows element of this trap, it is claimed. The bellows are made from phosphor bronze tubing hydraulically formed, and with end plates brazed on and not soldered, which accounts for its ability to withstand high pressures and temperatures. Style "C" is of cast iron construction and good for pressures up to 200 pounds, and made in angle type so trap drains itself when steam is turned off. This feature is desirable on outside installations as it prevents freezing. This trap also has the brazed bellows element as described above, which gives it an intermittent discharge and large capacity for both water and air. Valves and seats are of hardened stainless steel.

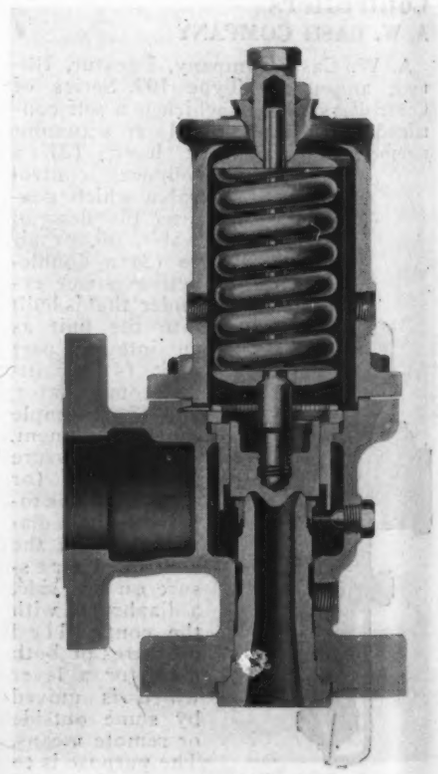


Style C

Oil Relief Valve

CONSOLIDATED ASHCROFT HANCOCK COMPANY

Consolidated Ashcroft Hancock Company, Consolidated Safety Valve Division, announces a new relief valve for oil, vapors or gases, for pressures up to 1000 pounds and temperatures up to 900°F. The manufacturer states that the special features of this relief valve are the outside bevel seat which prevents coking or pocketing of oil in the operating chamber, and the single blowdown ring which makes blow down control simple and reliable. The reinforced, extended bushing eliminates distortion strains. The cover is easily removable, making the working parts accessible for inspection and cleaning. Each valve is set at the exact popping point in the company's high pressure, high temperature testing laboratory before shipment.



Oil Relief Valve

CATALOGS . . . BULLETINS

Helpful Publications Which Manufacturers Will Be Glad to Send Free for the Asking

Air Filters
Coppus Engineering Corporation, Worcester, Mass., is distributing Bulletins F. 320-3, and F. 310-2, descriptive respectively of air filters for motor and generator intakes and for industrial use; and filters for compressors, engines, etc.

Containers
Wilson & Bennett Manufacturing Company, 6566 South Menard Ave., Chicago, is distributing a 128-page catalog covering a wide range of steel containers for the products of many industries. Includes color pages showing typical lithographed containers.

Hose
Thiokol Corporation, Yardville, N. Y., is distributing a pamphlet giving data on the use of Thiokol in oil-proof loading hose.

Insulation
Armstrong Cork Products Company, Lancaster, Pa., is distributing a 32-page illustrated catalog on cork coverings for cold lines, with descriptions of uses and engineering data.

Handling Materials
The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog 565 consisting of 112 pages covering a wide range of bucket elevators and other conveying equipment.

Bronze Fittings
Walworth Company, 60 East 42nd St., New York, in two current bulletins describes its line of threadless bronze fittings for bronze pipe, and its brazing methods for making joints.

Gauging
J. H. Bunnell & Company, 215 Fulton St., New York, is distributing an illustrated 12-page catalog dealing with MacCreedy fluid level indicator, an automatic device for gauging fluid levels in tanks.

Motors
The Louis Allis Company, Milwaukee, recently published a special bulletin dealing with the special characteristics and containing other important information regarding electric motors for centrifugals.

Draft Gage
The Hays Corporation, Michigan City, Indiana, is distributing a new Draft Gage Catalog PGA-35, covering its line of dry type pointer draft gages, inclined tube, direct reading, U-tube and vernier scale gages and dry type draft recorders.

Stainless Steels
Electro Metallurgical Company, 30 East 42nd St., New York, is distributing a pamphlet of interest to users of stainless steels, entitled "Stainless Steels Treated with Columbium", showing how the addition of columbium to the austenitic types of stainless steels results in elimination of intergranular corrosion.

Stoneware
The United States Stoneware Company, 50 Church Street, New York, is distributing Bulletin 801, a technical treatment of the subject of quick setting, acid-proof cements for acid-proof tank, acid-proof tower and acid-proof floor construction.

Refractories
Harbison-Walker Refractories Company, Farmers Bank Building, Pittsburgh, is distributing three bulletins dealing with three types of high temperature bonding mortars—Thermolith (with a chrome ore base); Firebond (with a silica base) and Harwaco Bond (with a diaspore base). Each bulletin contains a list of applications to which the product is suited.

Control Valve
C. J. Tagliabue Manufacturing Company, Park and Nostrand Avenues, Brooklyn, N. Y., is distributing Bulletin 1117 "Tag Diaphragm Valves", which illustrates and describes a newly developed valve for control work, and also covers the company's entire line of valves.

Compressors and Vacuum Pumps
Ingersoll-Rand Company, 11 Broadway, New York, has issued a new 32-page, illustrated catalog covering its line of "Type 30" industrial compressors and vacuum pumps, ¼ to 15 h.p., pressures up to 1000 pounds.

Floats
W. H. Nicholson & Company, 203 Oregon Street, Wilkes-Barre, Pennsylvania, has issued a new bulletin, No. 635, illustrating and describing the new Nicholson welded steel as well as stainless steel floats for steam traps, water columns, tanks, float valves, liquid level controls and the like. Floats are round, elliptical or special shapes, and list prices, weights and buoyancy of round floats are given.

Refractories
M. H. Detrick Company, 140 South Dearborn street, Chicago, is distributing a new bulletin "Detred—the new arch wall construction with the Detrick Tread." The well illustrated 15-page booklet includes full details of application, drawings and pertinent engineering information.

Combustion Control
Smoot Engineering Corporation, 2240 Diversey Parkway, Chicago, has published a new 32-page data book on the subject of mechanical combustion control, which contains a complete discussion of the basic problems of boiler operation and an evaluation of their importance in efficient steam generation. It is fully illustrated and contains a large number of diagramatic illustrations.

Regulation
The McAlear Manufacturing Company, 1901 South Western Avenue, Chicago, has published a 96-page bulletin describing all of its type of regulators for reducing and controlling steam, water, air, gas or oil pressures. Valuable engineering data and charts are included and blue prints supplementing descriptive test of each regulator show practical applications.

Alloy Cast Irons
International Nickel Company, 67 Wall street, New York, has published a new data sheet "Nickel Alloy Cast Irons and Their Special Applications in Petroleum Production Equipment."

Laboratory Apparatus
American Meter Company, 60 East 42nd street, New York, is distributing bulletin AG-2 dealing with Laboratory Gas Testing Apparatus. The 16-page bulletin is well illustrated and descriptions of apparatus are given in detail.

Valves
The Fairbank Company, New York, has published a new, well illustrated 56-page catalog dealing with its full line of valves. Descriptions and prices are included, and data on Dart unions is given.

Motor Brushes
Ohio Carbon Company, 12508 Berea Road, Lakewood, Ohio, has revised and re-issued its interesting booklet "The Brush Phase of Motor Maintenance" and will gladly mail copies to those interested.

Pumps
Worthington Pump and Machinery Corporation, Harrison, New Jersey, is distributing an illustrated eight-page booklet W, 450-B17 A—covering its deep well turbine pumps. Cross section views show details of construction and booklet includes tables of sizes and capacities, and list of applications.

Control
Taylor Instrument Companies, Rochester, N. Y., has issued a new 36-page catalog dealing with its "Dubl-Response" control systems. The catalog was prepared with the view to enabling the reader to analyze control problems, and is complete with descriptive data, diagrams, and engineering information.

Diesel Engines
Cooper-Bessemer Corporation, Mount Vernon, Ohio, is distributing a new bulletin entitled "Type GA Single- and Twin-Cylinder Horizontal Diesel Engines" and describes a Diesel engine of 25-110 B. H. P. specifically developed for stationary service for the small power user.

Welding Booklet
Linde Air Products Company, 30 East 42nd street, New York, announces publication of "The Metallurgy of Oxy-Acetylene Welding of Steel." This booklet, by J. H. Crichett, vice president, Union Carbide and Carbon Research Laboratories, is an informative discussion of the physical and chemical principles involved in welding steel.

Controllers
A. W. Cash Company, P. O. Box 135 Decatur, Illinois, has issued Bulletin 963 dealing with its line of self contained controllers for governing flow of water, oil or air. Bulletin is 16 pages, well illustrated and containing all pertinent data.

Equipment
Worthington Pump and Machinery Corporation, Harrison, N. J., recently has issued the following bulletins on various items of equipment: W-317-B4, Worthington Type F single stage volute vertical centrifugal pumps; W-103-B 1 Worthington Type PC snow pot valve type liquid end horizontal duplex pumps for general services handling liquids up to 800 lbs. per sq. in.; W-450-B22, Worthington No. 5 Sump Pump; L-620-B6B, Worthington Types VS and VA2, Worthington air compressor units for general industrial uses; L-620-B5A, Worthington air compressor units for oil and gas engine starting; and W- 200-B2A, Worthington welded steel shell construction, folded tube layer arrangements surface condensers.

Formulae
Glyco Products, Inc., 949 Broadway, New York, has issued a new revised catalog containing interesting information and formulae on emulsions, polishes, abrasives, disinfectant, bronze lacquers, synthetic resins and waxes, adhesives, etching pastes, cutting and spraying oils, soluble oil, etc. In addition the catalog contains valuable chemical tables.

Thermometers
C. J. Tagliabue Manufacturing Company, Park and Nestrand avenues, Brooklyn, N. Y., has issued a new catalog dealing with its line of thermometers. Number 1125 contains 24 pages of conveniently arranged listings of the complete Tag line of industrial thermometers, metal and woodback thermometers, hygrometers, U gauges, mercurial vacuum gauges and mercurial barometers.

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(Address manufacturer direct)

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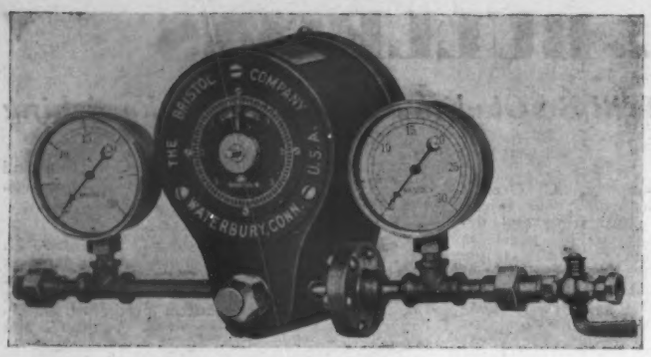

Ends

VIOLENT STABILIZER

fluctuations

Correctly balanced processing is essential to refinery efficiency. This applies particularly to stabilizer operations. By holding the top pressure in the stabilizer as well as the steam pressure in the reboiler within the permissible limits, there is no danger of any violent change occurring in steam load. Or of disastrous variations in the quality of the volatile products leaving the stabilizer.

Bristol's small* yet remarkably effective Valve Mounted Pressure Controller puts an end to upsetting conditions. Furnished in a bronze case, finished in black, complete with air gauges, air filter, shut-off cock. For nine pressure ranges from 1 to 15 lbs. per sq. in. up to 100 to 400 lbs. per sq. in.

Write for Catalogue 4000, Instrument Section.

***Overall dimensions 10 in. wide x 6⅞ in. high x 4½ in. deep.**

Above: Bristol's Air Operated Pressure Controller, Single Service Valve Mounted Type, Direct Acting Model 425. Also supplied in Single Service and Double Service Distance Types with ¼ inch pipe size union connections for pressure control.

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Write us and see how this advantage can be applied to your operations.

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Branch Offices: Akron, Birmingham, Boston, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco. Canada: The Bristol Company of Canada, Ltd., Toronto, Ontario. England: Bristol Instrument Co., Limited, London, S.E. 14.

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PIONEERS IN PROCESS CONTROL SINCE 1889

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